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User's Instructions for the SHORTZ and LONGZ Computer Programs. Volume II

H. E. Cramer Co., Inc.
Salt Lake City, UT

Prepared for

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USER'S INSTRUCTIONS FOR THE SHORTZ AND LONGZ COMPUTER PROGRAMS

(VOLUME II)

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16. ABSTRACT

The SHORTZ and LONGZ computer programs are designed to calculate the short-term and long-term ground-level pollutant concentrations produced at a large number of receptors by emissions from multiple stack, building and area sources. SHORTZ and LONGZ are applicable in either rural or urban areas of both flat and complex terrain. SHORTZ and LONGZ are written in FORTRAN and are specifically designed for use on a UNIVAC 1110 (or other UNIVAC 1100 series) computer. Both programs require a random-access mass storage device. SHORTZ requires approximately 55K words of core and LONGZ requires approximately 50K words of core. Volume I of the User's Instructions contains a detailed technical discussion of the dispersion-model equations implemented by SHORTZ and LONGZ and detailed user's instructions for the two programs. Volume II contains appendices which include: (1) complete listings of the SHORTZ and LONGZ programs, (2) example SHORTZ and LONGZ problems, (3) coding forms for card input to SHORTZ and LONGZ, (4) discussions of the development and testing of the stack-tip downwash and complex terrain algorithms used by SHORTZ and LONGZ, and (5) a SHORTZ meteorological preprocessor program for use with National Weather Service (NWS) surface and upper-air meteorological data.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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(VOLUME II)

by

Jay R. Bjorklund and James F. Bowers

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Project Officer

Alan J. Cimorelli
U. S. Environmental Protection Agency, Region III
Curtis Building
Sixth and Walnut Streets
Philadelphia, Pennsylvania 19106

H. E. Cramer company, inc.
UNIVERSITY OF UTAH RESEARCH PARK
POST OFFICE BOX 8049
SALT LAKE CITY, UTAH 84108

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APPENDIX A

COMPLETE FORTRAN LISTING OF THE SHORT-TERM MODEL (SHORTZ) COMPUTER PROGRAM

The enclosed listing of the SHORTZ program is different from the original made available to the general public in December 1979, due to coding revisions made to ease the conversion of the program to other than UNIVAC 1100 series computers. Comments have been added within the program listing for those areas that still require modification for other computers. Also, the several coding errors that have been discovered in the SHORTZ program since the program was made available to the general public are corrected in the following listing.

The differences in logic between the December 1979 and March 1982 versions of SHORTZ are denoted by an arrow (→) in the margin. A downward pointing arrow (↓) next to a line indicates that the changes begin at this line and continue until an upward pointing arrow (↑) is found. A horizontal arrow (→) pointing to a line indicates a change in that line only. A horizontal arrow located between two consecutive lines indicates changes in both lines or deletions. Also, it should be noted that the line numbers, statement numbers and sequence numbers in the December 1979 and March 1982 versions of SHORTZ are different.

```
C$                    ***** PROGRAM SHORTZ *****                           S0100000
C$                                                                         S0100010
C$    PARAMETER MKO CONTROLS THE AMOUNT OF CORE STORAGE AVAILABLE FOR      S0100020
C$    THE SOURCES. THIS PARAMETER IS NORMALLY SET TO 300. HOWEVER IT       S0100030
C$    CAN BE INCREASED IF NECESSARY. IF YOU ARE USING TAPE INPUT MKO       S0100040
C$    MUST BE THE SAME VALUE IT WAS SET TO WHEN THE TAPE WAS WRITTEN.      S0100050
C$    ALSO, IF YOU MODIFY MKO AND WRITE A TAPE MAKE SURE TO MAKE NOTE      S0100060
C$    OF THE CHANGE ON THE TAPE. CHECK SUBROUTINE BLOCK DATA, MODEL AND    S0100070
C$    OUTPT ALSO.                                                          S0100080
C                                                                          S0100090
      PARAMETER MKO=300                                                    S0100100
C                                                                          S0100110
C$         (MAXIMUM MKO = 1000.                                            S0100120
C$                                                                         S0100130
C$                                                                         S0100140
C$    PARAMETER MMM CONTROLS THE AMOUNT OF CORE STORAGE AVAILABLE FOR      S0100150
C$    THE CALCULATION GRID SYSTEM, ELEVATIONS AND CONCENTRATION ARRAYS     S0100160
C$    IN BLANK COMMON ARRAY OF. BLANK COMMON SHOULD BE COLLECTED AS THE    S0100170
C$    LAST ELEMENT IN THE ABSOLUTE PROGRAM.                                S0100180
C$       MMM >= 6*(NXPNTS*NYPNTS+NXWYPT)+NXPNTS+NYPNTS+2+NXWYPT            S0100190
C$             (MAXIMUM MMM = 64000)                                       S0100200
C                                                                          S0100210
      PARAMETER MMM=12000                                                  S0100220
C                                                                          S0100230
C$                                                                         S0100240
C$                                                                         S0100250
C$                                                                         S0100260
C     THIS PROGRAM IS DESIGNED TO CALCULATE GROUND LEVEL GASEOUS OR        S0100270
C     PARTICULATE CONCENTRATION FROM MULTIPLE SOURCES ON AN HOURLY,        S0100280
C     OR ANY AVERAGE OVER HOURS. THE REFERENCE GRID SYSTEM CAN BE          S0100290
C     CARTESIAN OR POLAR COORDINATES WITH THE CARTESIAN ORIGIN ASSUMED     S0100300
C     TO BE 0,0 AND THE POLAR ORIGIN EITHER 0,0 OR RELATIVE TO SOME        S0100310
C     CARTESIAN (UTM) POINT. THE PROGRAM IS CAPABLE OF PRODUCING           S0100320
C     CONCENTRATION FROM UP TO 300 SOURCES (ELEVATED STACKS, BUILDING      S0100330
C     AND OR AREA SOURCES).                                                S0100340
C                                                                          S0100350
C                                                                          S0100360
C    ******************************************************************S0100370
```

```
C                                                                       S0100380
C     THE ARRAY OF (BLANK COMMON) CONTAINS THE X AND Y RECEPTOR POINTS, S0100390
C     THE CONCENTRATIONS AND TERRAIN HEIGHTS.                           S0100400
C     THE DIMENSION OF QF MUST BE GREATER THAN OR EQUAL TO              S0100410
C     (NXPNTS+NYPNTS+NXWYPT)*6+NXPNTS+NYPNTS+2*NXWYPT                   S0100420
C     THE ABOVE PARAMETERS ARE DEFINED IN SUBROUTINE MODEL.  PROGRAM    S0100430
C     EXECUTING AND CORE USAGE ARE MOST EFFICIENT IF THE DIMENSION OF   S0100440
C     QF EQUALS THE ABOVE LIMITING EXPRESSION.                          S0100450
C     THE ARRAYS ARE DIMENSIONED AS FOLLOWS  X(NXPNTS+NXWYPT),          S0100460
C     Y(NYPNTS+NXWYPT),CON(NXPNTS*NYPNTS+NXWYPT,5),ZZ(NXPNTS*NYPNTS+    S0100470
C     NXWYPT)                                                           S0100480
C                                                                       S0100490
C$$$$                                                                   S0100500
C     NOTE THAT ALL CODING THAT BEGINS WITH C$$$$ AND ENDS WITH C$$$$   S0100510
C     ASSUMES A 36 BIT WORD AND MUST BE MODIFIED FOR MACHINES WITH      S0100520
C     OTHER THAN 36 BITS PER INTEGER WORD.                              S0100530
C$$$$                                                                   S0100540
C                                                                       S0100550
      INTEGER TITLE,TYPE,HOUR,DATS,TITLB                                S0100560
C                                                                       S0100570
      DIMENSION TITLB(20)                                               S0100580
C                                                                       S0100590
      COMMON QF(MMM)                                                    S0100600
      COMMON /DIM/ NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NHOURS,NDAYS      S0100610
     1,IOVRSN                                                           S0100620
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0100630
      COMMON /FP1/ ROTATE,TK,G,ZR,HA,GAMMA1,GAMMA2,XRY,DECAY            S0100640
     1,UTMX,UTMY                                                        S0100650
      COMMON /MET/ THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,SIGAPU,SIGEPL, S0100660
     1SIGAPL,ALPHA,HOUR,NUMSOB(MKQ),QB(MKQ),TSB(MKQ),VOLB(MKQ)          S0100670
      COMMON /SOR/ NUMSO(MKQ),TYPE(MKQ),Q(MKQ),DX(MKQ),DY(MKQ),H(MKQ),  S0100680
     1HS(MKQ),TS(MKQ),VOL(MKQ),DTH(MKQ),RDS(MKQ),NS(MKQ),VS(10,MKQ),    S0100690
     2FREQ(10,MKQ),JFLG(MKQ),H10(MKQ),H10SR(MKQ),VSQ(MKQ),W(MKQ)        S0100700
     3,IFTAP(MKQ),CHGQ(MKQ)                                             S0100710
      COMMON /RST/ ISW(20),TITLE(20),KUNR(6),KFNR(3),DD1(3),I3,DATS(2), S0100720
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0100730
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0100740
      COMMON /ERF/ W2,W3                                                S0100750
```

```
C                                                                       S0100760
      EQUIVALENCE (TITLB(1),IPRT(1)),(NSOURC,DMYNSO)                    S0100770
C                                                                       S0100780
C                                                                       S0100790
C***********************************************************************S0100800
C                            *** START PROGRAM ***                      S0100810
C                                                                       S0100820
C     INPUT RUN TITLE                                                   S0100830
      READ (IUNT,9001) KSW,TITLE                                        S0100840
      READ (IUNT,9004) KUNR,KFNR,NINTP,NOTTP,NINFL,NOTFL                S0100850
      IF (KSW .EQ. 2) GO TO 10                                          S0100860
      IF (NINTP .LE. 0) NINTP = 1                                       S0100870
      IF (NINFL(1) .LE. 0) NINFL(1) = 2                                 S0100880
   10 IF (KSW .EQ. 1) GO TO 20                                          S0100890
      IF (NOTTP .LE. 0) NOTTP = 1                                       S0100900
      IF (NOTFL(1) .EQ. 0) NOTFL(1) = 3                                 S0100910
   20 CONTINUE                                                          S0100920
      IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 40                           S0100930
C     READ TAPE BUFFER, 8 WORDS STORED INTO NSOURC                      S0100940
      CALL INPOUP(-1,DMYNSO,8)                                          S0100950
      IF (NOGO .GT. 0) GO TO 60                                         S0100960
      NGROPS = NSOURC                                                   S0100970
      DO 30 I=1,20                                                      S0100980
   30 TITLB(I) = TITLE(I)                                               S0100990
      READ (IUNT,9002) NSOURC,NGROUP                                    S0101000
      GO TO 50                                                          S0101010
   40 CONTINUE                                                          S0101020
C     INPUT SIZE PARAMETERS                                             S0101030
      READ (IUNT,9003) NXPNTS,NYPNTS,NXWYPT,NSOURC,NHOURS,NGROUP,NDAYS  S0101040
   50 CONTINUE                                                          S0101050
C     THE X AXIS ARRAY STARTS AT QF(1)                                  S0101060
      J1 = NXPNTS+1                                                     S0101070
C     THE Y AXIS ARRAY STARTS AT QF(J1)                                 S0101080
      J2 = J1+NYPNTS+NXWYPT*2                                           S0101090
C     THE CON ARRAY STARTS AT QF(J2)  ( CON(NXPNTS,NYPNTS,5) )          S0101100
C     THE TERRAIN HEIGHT ARRAY Z(I,J) STARTS AT QF(J3)                  S0101110
      NXXYY = NXPNTS*NYPNTS+NXWYPT                                      S0101120
      J3 = J2+NXXYY*5                                                   S0101130
```

```
C                                                                       S0101140
C     EXECUTE CONCENTRATION MODEL                                       S0101150
      CALL MODEL(QF,QF(J1),QF(J2),QF(J3),NKXYY)                         S0101160
C     END PROGRAM                                                       S0101170
   60 CONTINUE                                                          S0101180
      STOP                                                              S0101190
 9001 FORMAT (I1,19A4,A3)                                               S0101200
 9002 FORMAT (12X,I4,4X,I4)                                             S0101210
 9003 FORMAT (20I4)                                                     S0101220
 9004 FORMAT (9A4,8I4)                                                  S0101230
      END                                                               S0101240
      BLOCK DATA                                                        S0200000
C                                                                       S0200010
      PARAMETER MKQ=30)                                                 S0200020
C                                                                       S0200030
      INTEGER TITLE,TYPE,HOUR,DATS                                      S0200040
C                                                                       S0200050
      COMMON /DIM/ NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NHOURS,NDAYS      S0200060
     1,IOVRSN                                                           S0200070
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0200080
      COMMON /FP1/ ROTATE,TK,G,ZR,HA,GAMMA1,GAMMA2,XRY,DECAY            S0200090
     1,UTMX,UTMY                                                        S0200100
      COMMON /MET/ THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,SIGAPU,SIGEPL, S0200110
     1SIGAPL,ALPHA,HOUR,NUMSOB(MKQ),QB(MKQ),TSB(MKQ),VOLB(MKQ)          S0200120
      COMMON /SOR/ NUMSQ(MKQ),TYPE(MKQ),Q(MKQ),DX(MKQ),DY(MKQ),H(MKQ),  S0200130
     1HS(MKQ),TS(MKQ),VOL(MKQ),DTH(MKQ),RDS(MKQ),NS(MKQ),VS(10,MKQ),    S0200140
     2FREQ(10,MKQ),JFLG(MKQ),H10(MKQ),H10SQ(MKQ),VSQ(MKQ),W(MKQ)        S0200150
     3,IFTAP(MKQ),CHGQ(MKQ)                                             S0200160
      COMMON /RST/ ISW(20),TITLE(20),KUNR(5),KFNR(3),DD1(3),I3,DATS(2), S0200170
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0200180
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0200190
      COMMON /ERF/ W2,W3                                                S0200200
C                                                                       S0200210
      DATA MUNT/4HMETE,2HRS,4HDEGR,3HEES/                               S0200220
      DATA IBLNK/1H /,DATS/2*1H /                                       S0200230
      DATA IUNT,JUNT/5,6/                                               S0200240
      DATA NOGO,IT1REC,IT2REC/3*0/,ITABLE,IPAGE/2*0/,ND/1/              S0200250
C     CURRENT VERSION OF ROUTINE INPOUP + 9900                          S0200260
      DATA IOVRSN/9903'                                                 S0200270
C                                                                       S0200280
      END                                                               S0200290
      SUBROUTINE MODEL(X,Y,CON,ZZ,NXXYY)                                S0300000
C$                                                                      S0300010
C$                                                                      S0300020
C$                                                                      S0300030
C$    PARAMETER MKQ CONTROLS THE AMOUNT OF CORE STORAGE AVAILABLE FOR   S0300040
C$    THE SOURCES. THIS PARAMETER IS NORMALLY SET TO 300. HOWEVER IT    S0300050
C$    CAN BE INCREASED IF NECESSARY. IF YOU ARE USING TAPE INPUT MKQ    S0300060
C$    MUST BE THE SAME VALUE IT WAS SET TO WHEN THE TAPE WAS WRITTEN.   S0300070
C$    ALSO, IF YOU MODIFY MKQ AND WRITE A TAPE MAKE SURE TO MAKE NOTE   S0300080
C$    OF THE CHANGE ON THE TAPE. CHECK SUBROUTINE OUTPT ALSO.           S0300090
C                                                                       S0300100
      PARAMETER MKQ=300                                                 S0300110
C                                                                       S0300120
C$          (MAXIMUM MKQ = 1000.                                        S0300130
C$                                                                      S0300140
C$                                                                      S0300150
C     THIS SUBROUTINE IS THE MAIN CALCULATION AND PROCESSING ROUTINE    S0300160
C     OF THE SHORT TERM MODEL.                                          S0300170
C     ******************************************************************S0300180
C                                                                       S0300190
C               *-* PROGRAM INPUT PARAMETERS *-*                        S0300200
C         *- MODEL AND CONTROL INPUTS -*                                S0300210
C                                                                       S0300220
C-CARD 1                                                                S0300230
C     (I1,19A4,A3) FORMAT                                               S0300240
C     KSW - SPECIAL SAVE TAPE FLAG. IF = 1 THE PROG READS ALL INPUT     S0300250
C           DATA FROM TAPE UNIT NINFL. ONLY CARD GROUPS 1,1A,2,3,7,8,9, S0300260
C           10 AND 11A CAN BE INPUT.                                    S0300270
C           WHEN TAPE INPUT IS USED SOURCES CAN BE ADDED TO THE TAPE    S0300280
C           SOURCES, DELETED FROM THE INPUT TAPE OR MODIFIED.           S0300290
C           IF = 2 THE PROG WRITES ALL DATA AND CALCULATIONS TO SAVE    S0300300
C           TAPE ON UNIT NOTFL. 2 EOF'S ARE WRITTEN AT THE END OF EACH  S0300310
C           RUN AND THE OUTPUT TAPE POSITIONED BETWEEN THEM.            S0300320
C           IF = 3 THE PROGRAM ASSUMES BOTH INPUT AND OUTPUT TAPE       S0300330
C     TITLE - 79 CHARACTER TITLE AND PAGE HEADING                       S0300340
C-CARD 1A                                                               S0300350
C     (6A4,3A4,8I4)                                                     S0300360
C     KUNR - 24 CHARACTERS TO IDENTIFY UNITS. ENCLOSE UNITS IN          S0300370
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```
C            PARENTHESIS. IF ALL BLANKS PROG USES (MICROGRAMS/CUBIC METES0300380
C            R)                                                         S0300390
C     KFNR - 12 CHARACTERS TO IDENTIFY SOURCE STRENGTH UNITS. IF BLANKS S0300400
C            PROGRAM USES (GRAMS/SEC).                                  S0300410
C     NINTP - NO. OF INPUT DATA TAPES (MULTIPLE REEL INPUT FILE(S))     S0300420
C             (DEFAULT = 1 IF KSW SET FOR INPUT TAPES)                  S0300430
C     NOTTP - NO. OF OUTPUT DATA INVENTORY TAPES (MULTIPLE REEL OUTPUT  S0300440
C             FILE(S)) (DEFAULT = 1 IF KSW SET FOR OUTPUT TAPES). THIS  S0300450
C             IS NOT APPLICABLE TO OUTPUT TAPES GENERATED UNDER ISW(8). S0300460
C     NINFL - ARRAY OF UP TO 3 LOGICAL UNIT NUMBERS FOR THE NINTP       S0300470
C             INPUT TAPES. ALL 3 VALUES ARE READ. (DEFAULT IS           S0300480
C             NINFL(1) = 2)                                             S0300490
C     NOTFL - ARRAY OF UP TO 3 LOGICAL UNIT NUMBERS FOR THE NOTTP       S0300500
C             OUTPUT TAPES. ALL 3 VALUES ARE READ. (DEFAULT IS          S0300510
C             NOTFL(1) = 3). THIS IS NOT APPLICABLE TO TAPES GENERATED  S0300520
C             UNDER ISW(8).                                             S0300530
C-CARD 2 (IF KSW =1 OR =3 ONLY NSOURC AND NGROUP ARE READ FROM THIS CARDS0300540
C     (7I4) FORMAT                                                      S0300550
C     NXPNTS - NUMBER OF X COORDINATES IN THE REFERENCE GRID SYSTEM     S0300560
C     NYPNTS - NUMBER OF Y COORDINATES IN THE REFERENCE GRID SYSTEM     S0300570
C     NXWYPT - NUMBER OF DISCRETE OR SPECIAL IRREGULARLY SPACED         S0300580
C              X,Y CALCULATION POINTS                                   S0300590
C     NSOURC - NUMBER OF INPUT DATA CARD SOURCES (MAXIMUM = PARAMETER   S0300600
C              MKQ) (DEFAULT = 0). IF KSW =1 OR =3 THIS IS THE NUMBER   S0300610
C              OF SOURCE INPUT CARDS USED TO CHANGE, DELETE FROM OR ADD S0300620
C              TO THE SOURCE/CONCENTRATION INVENTORY.                   S0300630
C              OF SOURCE INPUT CARDS IDENTIFYING CHANGES TO BE MADE TO  S0300640
C              THE SOURCE/CONCENTRATION INVENTORY                       S0300650
C              IF NSOURC IS GREATER THAN ZERO AND TAPE INPUT IS BEING   S0300660
C              USED (KSW = 1 OR 3) THE TOTAL NUMBER OF SOURCES CANNOT   S0300670
C              EXCEED MKQ.                                              S0300680
C     NHOURS - TOTAL NUMBER OF MET OBSERVATIONS TO INPUT TO THE PROGRAM.S0300690
C              IF MET DATA IS HOURLY THIS IS THE TOTAL NUMBER OF HOURS  S0300700
C              TO INPUT OR IF 3 HOURLY THE NUMBER OF 3 HOURLY           S0300710
C              OBSERVATIONS TO INPUT. (DEFAULT = 24)                    S0300720
C     NGROUP - NUMBER OF DIFFERENT SOURCE GROUPS TO PRINT CONCENTRATION S0300730
C              (IF NGROUP=0 ONLY SUM OVER ALL SOURCES IS PRINTED)       S0300740
C              (MAXIMUM = 1000)                                         S0300750
```

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      C     NDAYS - NUMBER OF CASES OF MET DATA TO PROCESS. THIS IS THE NUMBERS0300760
      C             OF SETS OF MET DATA OF NHOURS EACH TO PROCESS OR IF       S0300770
      C             NHOURS = 24 THEN THE NUMBER OF DAYS. SEE ISW(11) FOR      S0300780
      C             CALCULATING THE AVERAGE OF PARTICULAR TIMES OF DAY OVER   S0300790
      C             MULTIPLE DAYS OR CASES. (DEFAULT = 1)                     S0300800
      C-CARD 3 (IF KSW =1 OR =3 ONLY ISW(2) THROUGH (6) AND ISW(10) ARE READ  S0300810
      C        FROM THIS CARD))                                               S0300820
      C     (20I4) FORMAT                                                     S0300830
      C     ISW(1) - NUMBER OF HOURS IN EACH INPUT MET OBSERVATION. IF INPUT  S0300840
      C              MET IS HOURLY PUNCH 1, IF 3 HOURLY PUNCH 3, ETC.         S0300850
      C              (DEFAULT = 1)                                            S0300860
      C     ISW(2) - IF=1 PRINT CONCENTRATION FOR EACH MET OBSERVATION INPUT  S0300870
      C              (DEFAULT = 0 OR NO OUTPUT)                               S0300880
      C     ISW(3) - NUMBER OF HOURS IN FIRST AVERAGE CONCENTRATION PRINTED   S0300890
      C              (DO NOT CONFUSE WITH ISW(2), DEFAULT = 0, ISW(3) MUST BE S0300900
      C              GREATER THAN ISW(1), BUT LESS THAN ISW(4) AND ISW(5).    S0300910
      C     ISW(4) - NUMBER OF HOURS IN SECOND AVERAGE CONCENTRATION PRINTED. S0300920
      C              (DEFAULT = 0, GREATER THAN ISW(3))                       S0300930
      C     ISW(5) - NUMBER OF HOURS IN THIRD AVERAGE CONCENTRATION PRINTED.  S0300940
      C              (DEFAULT = 0, GREATER THAN ISW(4).                       S0300950
      C     ISW(6) - OPTION USED TO CONTROL PRINTING OF ALL INPUTS EXCEPT     S0300960
      C              METEOROLOGICAL DATA.                                     S0300970
      C              IF = 0 GENERAL INPUT AND SOURCE DATA IS NOT PRINTED      S0300980
      C              IF = 1 PRINT GENERAL INPUT DATA ONLY (NO SOURCE DATA)    S0300990
      C              IF = 2 PRINT SOURCE INPUT DATA ONLY                      S0301000
      C              IF = 3 BOTH GENERAL INPUT DATA AND SOURCE DATA ARE       S0301010
      C                     PRINTED.                                          S0301020
      C     ISW(7) - IF SET NOT 0 THE PROGRAM READS CARD GROUP 5A, TERRAIN    S0301030
      C              HEIGHTS                                                  S0301040
      C     ISW(8) - OPTION USED TO CONTROL THE PRINTING OF METEOROLOGICAL    S0301050
      C              DATA FROM CARD GROUP 11.                                 S0301060
      C              IF = 0 METEOROLOGICAL DATA IS NOT PRINTED.               S0301070
      C              IF = 1 METEOROLOGICAL DATA IS PRINTED.                   S0301080
      C     ISW(9) - IF SET TO ZERO THE WIND SPEED POWER LAW IS BASED ON      S0301090
      C              ELEVATION ABOVE AIRPORT ELEVATION. IF THE HEIGHT IS BELOWS0301100
      C              AIRPORT NO POWER LAW IS USED.                            S0301110
      C              IF SET NON-ZERO THE WIND SPEED POWER LAW IS BASED ON     S0301120
      C              HEIGHT ABOVE TERRAIN AND A POWER LAW IS ALWAYS USED. IF  S0301130
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C                THE HEIGHT OF A BUILDING OR AREA SOURCE IS LESS THAN     S0301140
C                5 METERS, 5 METERS IS USED.                              S0301150
C     ISW(10) - IF SET TO ZERO ALL PRINTOUT IS SENT TO THE PRINTER,       S0301160
C                LOGICAL UNIT 6.  IF SET GREATER THAN ZERO PRINTOUT IS    S0301170
C                SENT TO THE LOGICAL UNIT SPECIFIED BY THE VALUE OF       S0301180
C                ISW(10).  EXCEPT FOR LOGICAL UNIT 6 THE PROGRAM ASSUMES S0301190
C                THAT A FILE HAS BEEN ASSOCIATED WITH THE LOGICAL UNIT    S0301200
C                NUMBER.                                                  S0301210
C                2 END-OF-FILE MARKS ARE WRITTEN ON THE LOGICAL UNIT AND S0301220
C                THE UNIT REWOUND.                                        S0301230
C     ISW(11) - IF SET NON-ZERO THE PROGRAM PRODUCES THE CONCENTRATION   S0301240
C                FOR THE SPECIFIED AVERAGING TIMES (ISW(2)-ISW(5))        S0301250
C                SUMMED AND AVERAGED OVER NDAYS. ONLY THE NDAYS AVERAGES S0301260
C                CAN BE OUTPUT.                                           S0301270
C     ISW(12) - IF = 1 THE PROGRAM READS THE FORMAT FOR THE SOURCE DATA  S0301280
C                       IN CARD GROUP 9A INTO THE ARRAY SFMT IN CARD      S0301290
C                       GROUP 9. (SEE CARD GROUPS 9 AND 9A).              S0301300
C                IF = 0 CARD GROUP 9 IS NOT READ AND THE PROGRAM READS    S0301310
C                       CARD GROUP 9A USING THE DEFAULT FORMAT GIVEN      S0301320
C                       UNDER SFMT IN CARD GROUP 9 BELOW.                 S0301330
C     ISW(13) - IF = 0 THE PROGRAM ASSUMES THE X,Y COORDINATE SYSTEM     S0301340
C                       IS IN CARTESIAN COORDINATES.                      S0301350
C                IF = 1 THE PROGRAM ASSUMES THE X,Y COORDINATE SYSTEM     S0301360
C                       IS IN POLAR COORDINATES WHERE X IS THE RANGE IN   S0301370
C                       METERS AND Y IS THE AZIMUTH BEARING IN DEGREES    S0301380
C                       FROM THE ORIGIN TO THE RECEPTOR MEASURED          S0301390
C                       CLOCKWISE FROM 0 DEGREES (NORTH).                 S0301400
C     ISW(14) - IF = 0 THE PROGRAM ASSUMES THE NXWYPT DISCRETE POINTS    S0301410
C                       ARE IN CARTESIAN COORDINATES.                     S0301420
C                IF = 1 THE PROGRAM ASSUMES THE DISCRETE POINTS ARE IN    S0301430
C                       POLAR COORDINATES.                                S0301440
C     ISW(15) - IF = 0 THE PROGRAM ASSUMES THE SOURCES ARE INPUT WITH    S0301450
C                       CARTESIAN COORDINATES.                            S0301460
C                IF = 1 THE PROGRAM ASSUMES THE SOURCES ARE INPUT WITH    S0301470
C                       POLAR COORDINATES.                                S0301480
C     ISW(16) - IF = 0 , THE PROGRAM ASSUMES THE PARAMETERS SIGAPU AND   S0301490
C                       SIGEPU ARE TO BE USED FOR ALL SOURCES INPUT.      S0301500
C                       ALSO, THE DEFAULTS FOR THESE PARAMETERS DEPEND    S0301510
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      C                       ON STABILITY AND WHETHER THE PROGRAM IS RUN IN    S0301520
      C                       THE RURAL OR URBAN MODE. THE PROGRAM IGNORES      S0301530
      C                       ANY DATA INPUT TO THE PARAMETERS SIGAPL AND       S0301540
      C                       SIGEPL.                                           S0301550
      C                IF = 1 , THE PROGRAM ASSUMES THE PARAMETERS SIGAPU AND   S0301560
      C                       SIGEPU ARE TO BE USED FOR STACK (TYPE=0) TYPE     S0301570
      C                       SOURCES ONLY. NO DEFAULT VALUES ARE PROVIDED.     S0301580
      C                       ALSO, THE PARAMETERS SIGAPL AND SIGEPL ARE TO BE  S0301590
      C                       USED FOR BUILDING (TYPE=1) AND AREA (TYPE=2) TYPES0301600
      C                       SOURCES ONLY. NO DEFAULT VALUES ARE PROVIDED FOR  S0301610
      C                       SIGAPL OR SIGEPL.                                 S0301620
      C        ISW(17) - RURAL/URBAN MODE OPTION. THIS OPTION IS IGNORED IF     S0301630
      C                  ISW(16) = 1. IF ISW(16) = 0 THIS OPTION CONTROLS THE   S0301640
      C                  DEFAULT SIGAPU AND SIGEPU VALUES.                      S0301650
      C                   IF = 0 RURAL MODE                                     S0301660
      C                   IF = 1 URBAN MODE                                     S0301670
      C                  THE PROGRAM USES THE FOLLOWING DEFAULT VALUES,         S0301680
      C                  DEPENDING ON STABILITY, IF SIGAPU OR SIGEPU IS NOT     S0301690
      C                  PUNCHED OR IS ZERO                                     S0301700
      C                                          - STABILITY -                  S0301710
      C                               A    B    C    D    E    F                S0301720
      C                        MODE            - DEFAULT SIGAPU -               S0301730
      C                     RURAL MODE .2495 .1544 .1051 .0655 .0501 .0336      S0301740
      C                     URBAN MODE .2495 .2495 .1544 .1051 .0565 .0665      S0301750
      C                                        - DEFAULT SIGEPU -               S0301760
      C                     RURAL MODE .1745 .1080 .0735 .0465 .0350 .0235      S0301770
      C                     URBAN MODE .1745 .1745 .1080 .0735 .0465 .0465      S0301780
      C        ISW(18) - ISW(20) - N/A                                          S0301790
      C IF KSW =1 OR =3 CARD GROUPS 4 THROUGH 6 ARE NOT READ BUT TAKEN FROM     S0301800
      C THE INPUT TAPE                                                          S0301810
      C-CARD GROUP 4 ,THIS CARD GROUP IS NOT READ IF NXPNTS=0)                  S0301820
      C        (8F10.0) FORMAT                                                  S0301830
      C        X - X AXIS OF THE REFERENCE GRID SYSTEM (METERS)                 S0301840
      C            CARTESIAN OR POLAR COORDINATES DEPENDING ON ISW(13). ALSO, IF S0301850
      C            ONLY 2 VALUES ARE PUNCHED AND NXPNTS IS GREATER THAN 2 THE   S0301860
      C            PROGRAM ASSUMES THE FIRST VALUE IS THE START OF THE AXIS AND S0301870
      C            THE SECOND IS AN INCREMENT TO USE TO GENERATE THE SECOND     S0301880
      C            THROUGH NXPNTS POINTS.                                       S0301890
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C-CARD GROUP 4A (THIS CARD GROUP IS NOT READ IF NXWYPT=0)                S0301900
C      (8F10.0) FORMAT                                                   S0301910
C      X - DISCRETE X POINTS IF NXWYPT > 0  (METERS)                     S0301920
C           CARTESIAN OR POLAR COORDINATES DEPENDING ON ISW(14).         S0301930
C-CARD GROUP 5 (THIS CARD GROUP IS NOT READ IF NYPNTS=0)                 S0301940
C      (8F10.0) FORMAT                                                   S0301950
C      Y - Y AXIS OF THE REFERENCE GRID SYSTEM (METERS)                  S0301960
C           CARTESIAN (METERS) OR POLAR (DEGREES) COORDINATES DEPENDING  S0301970
C           ON ISW(13). ALSO, IF ONLY 2 VALUES ARE PUNCHED AND NYPNTS IS S0301980
C           GREATER THAN 2 THE PROGRAM ASSUMES THE FIRST VALUE IS THE    S0301990
C           START OF THE AXIS AND THE SECOND IS AN INCREMENT TO USE TO   S0302000
C           GENERATE THE SECOND TO NYPNTS POINTS.                        S0302010
C-CARD GROUP 5A (THIS CARD GROUP IS NOT READ IF NXWYPT=0)                S0302020
C      (8F10.0) FORMAT                                                   S0302030
C      Y - DISCRETE Y POINTS IF NXWYPT > 0. (METERS)                     S0302040
C           CARTESIAN (METERS) OR POLAR (DEGREES) DEPENDING ON ISW(14).  S0302050
C-CARD GROUP 5B (IF ISW(7) = 0 THIS CARD GROUP IS NOT READ)              S0302060
C      (8F10.0) FORMAT                                                   S0302070
C      ZZ - TERRAIN ELEVATION ARRAY FOR EACH GRID CORNER (METERS)        S0302080
C            THE ZZ VALUES FOR THE GRID SYSTEM ARE READ WITH THE X AXIS  S0302090
C            ACROSS THE CARD(S). A NEW CARD IS STARTED FOR EACH Y AXIS.  S0302100
C-CARD GROUP 5C (IF ISW(7)=0 OR NXWYPT=0 OR KSW=1 OR 3 THIS GROUP IS     S0302110
C                   NOT READ)                                            S0302120
C           (8F10.0) FORMAT                                              S0302130
C           ZZ - TERRAIN ELEVATION IN METERS FOR DISCRETE POINTS         S0302140
C            THE ZZ VALUES FOR THE DISCRETE POINTS IF ANY ARE READ ACROSS S0302150
C            THE CARD(S) STARTING WITH A NEW CARD AFTER THE GRID VALUES  S0302160
C-CARD GROUP 6                                                           S0302170
C      (F7.0,F10.0,5F7.0,2F5.0,F11.0,F7.0) FORMAT                        S0302180
C      ROTATE - THIS PARAMETER IS USED TO CORRECT FOR ANY DIFFERENCE IN  S0302190
C               NORTH AS DEFINED BY THE X,Y GRID SYSTEM AND NORTH AS     S0302200
C               DEFINED BY THE WEATHER STATION AT WHICH THE WIND         S0302210
C               DIRECTION DATA WAS RECORDED. THE VALUE OF ROTATE IS      S0302220
C               SUBTRACTED FROM EACH WIND DIRECTION CATEGORY. ROTATE IS  S0302230
C               POSITIVE IF THE POSITIVE Y AXIS OF THE GRID SYSTEM POINTSS0302240
C               TO THE RIGHT OF NORTH AS DEFINED BY THE WEATHER STATION  S0302250
C               AND NEGATIVE WHEN THE POSITIVE Y AXIS OF THE GRID SYSTEM S0302260
C               POINTS TO THE LEFT.                                      S0302270
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C                 THE PROGRAM ASSUMES THAT THE METEOROLOGICAL DATA      S0302280
C              (WIND DIRECTION) RECORDED AT THE WEATHER STATION IS      S0302290
C              APPLICABLE AT THE SOURCE LOCATION. MOST WEATHER STATIONS S0302300
C              RECORD DIRECTION RELATIVE TO TRUE NORTH AND MOST GRID    S0302310
C              SYSTEMS ARE RELATIVE TO TRUE NORTH. HOWEVER, SOME WEATHERS0302320
C              STATIONS RECORD DIRECTION RELATIVE TO MAGNETIC NORTH.    S0302330
C              ALSO, UTM (UNIVERSAL TRANSVERSE MERCATOR) COORDINATES    S0302340
C              ARE ORIENTED RELATIVE TO TRUE NORTH AT THE CENTER OF THE S0302350
C              UTM ZONE, BUT HAVE AN INCREASING POS. OR NEG. DECLINATIONS0302360
C              ANGLE AS YOU APPROACH THE ENDS OF THE UTM ZONE.          S0302370
C     TK - MODEL UNITS CONVERSION FACTOR - USED TO CHANGE SOURCE INPUT  S0302380
C          UNITS TO OBTAIN DESIRED CONCENTRATION OUTPUT UNITS (IF BLANK S0302390
C          OR ZERO PROGRAM ASSUMES Q IS IN GRAMS/SEC                    S0302400
C          AND SETS TK = 1.0E6 ASSUMING OUTPUT CONCENTRATION UNITS ARE  S0302410
C          MICROGRAMS/CUBIC METER.                                      S0302420
C     HA - ELEVATION OF AIRPORT OR WEATHER STATION (METERS)             S0302430
C     UTMX - OPTIONAL X COORDINATE OF ORIGIN OF POLAR COORDINATES       S0302440
C            IN CARTESIAN (UTM) SYSTEM (METERS) (DEFAULT=0.0).          S0302450
C            IF INPUT ALL POLAR COORDINATES ARE RELATIVE TO UTMX,UTMY.  S0302460
C            (IF DISCRETE RECEPTORS ARE INPUT IN POLAR COORDINATES WITH S0302470
C             EITHER UTMX OR UTMY PUNCHED NON-ZERO THE PROGRAM CONVERTS S0302480
C             THE DISCRETE RECEPTORS TO CARTESIAN (UTM) COORDINATES FOR S0302490
C             THE CONCENTRATION PRINTED OUTPUT TABLES)                  S0302500
C     UTMY - OPTIONAL Y COORDINATE OF ORIGIN OF POLAR COORDINATES       S0302510
C            IN CARTESIAN (UTM) SYSTEM (METERS) (DEFAULT=0.0).          S0302520
C            IF INPUT ALL POLAR COORDINATES ARE RELATIVE TO UTMX,UTMY.  S0302530
C     G - ACCELERATION OF GRAVITY (METERS/SEC**2) (IF 0 PROG ASSUMES 9.8S0302540
C     ZR - HEIGHT OF MEASUREMENT OF WIND SPEED (METERS, IF BLANK OR 0   S0302550
C          PROGRAM ASSUMES 6.096 METERS ABOVE GROUND (OR 20 FEET)       S0302560
C     GAMMA1 - ENTRAINMENT PARAMETER FOR AN UNSTABLE ATMOSPHERE (IF 0 ORS0302570
C              BLANK PROGRAM ASSUMES .6)                                S0302580
C     GAMMA2 - ENTRAINMENT PARAMETER FOR A STABLE ATMOSPHERE (IF 0 OR   S0302590
C              BLANK PROGRAM ASSUMES .66)                               S0302600
C     DECAY - DECAY COEFFICIENT FOR POLLUTANT REMOVAL BY PHYSICAL OR    S0302610
C             CHEMICAL PROCESSES (IF BLANK OR ZERO DECAY TERM IS        S0302620
C             IGNORED)                                                  S0302630
C     XRY - DISTANCE OVER WHICH RECTILINEAR PLUME EXPANSION OCCURS      S0302640
C           DOWNWIND FROM AN IDEAL POINT SOURCE (IF BLANK OR ZERO PROG  S0302650
C                ASSUMES 50 METERS)
C-CARD GROUP 7                                                          S0302660
C-CARD GROUP 7 AND 8 ARE NOT READ IF NGROUP=0                           S0302670
C        (20I4) FORMAT                                                  S0302680
C        NSOGRP - ARRAY CONTAINING THE NUMBER OF SOURCE NUMBERS IN EACH OF S0302690
C                 THE NGROUP CONCENTRATION REPORTS THAT ARE INPUT IN IDSOR S0302700
C                   (MAXIMUM OF 1000 VALUES)                            S0302710
C-CARD GROUP 8                                                          S0302720
C        (13I6) FORMAT                                                  S0302730
C        IDSOR -ARRAY CONTAININGTHE GROUPS OF SOURCE ID NUMBERS THAT ARE TOS0302740
C                BE USED IN CONCENTRATION REPORTS (MAXIMUM OF 1000 VALUES) S0302750
C                (EXAMPLE. ASSUME NGROUP EQUALS 4 AND NSOGRP(1)=5,      S0302760
C                NSOGRP(2)=2,NSOGRP(3)=1, AND NSOGRP(4)=2. ALSO, ASSUME S0302770
C                THE SOURCE NUMBER ARRAY IDSOR CONTAINS THE FOLLOWING   S0302780
C                STRING OF NUMBERS 8,32,-39,52,70,100,-105,107,37-49. THE S0302790
C                FIRST CONCENTRATION REPORT WILL CONSIST OF THE SUM OF  S0302800
C                SOURCES 8, 32 THROUGH 39, 52 AND 70. THE SECOND WILL   S0302810
C                CONSIST OF THE SUM OF SOURCES 100 THROUGH 105. THE THIRD, S0302820
C                SOURCE 107 ONLY. THE FOURTH, THE SUM OF SOURCES 37     S0302830
C                THROUGH 49)                                            S0302840
C-CARD GROUP 9 (NOT READ IF ISW(12) = 0)                                S0302850
C        (20A4) FORMAT                                                  S0302860
C        SFMT - FORTRAN FORMAT USED TO READ CARD GROUP 9A INCLUDING      S0302870
C               LEADING AND ENDING PARENTHESIS. IF THIS ARRAY IS NOT READ S0302880
C               (ISW(12)=0) THE PROGRAM USES THE DEFAULT FORMAT -       S0302890
C               (I5,3I1,F10.0,8F7.0,I2) TO READ CARD GROUP 9A.          S0302900
C-CARD GROUP 9A (THIS CARD GROUP IS NOT READ IF NSOURC = 0)             S0302910
C        (FORMAT IS DEFINED BY SFMT ABOVE)                              S0302920
C        NUMSO - SOURCE IDENTIFICATION NUMBER (RANGE = 1 TO 20000)      S0302930
C        TYPE - SOURCE TYPE                                             S0302940
C               0 - ELEVATED POINT OR VOLUME SOURCE  (OR BLANK)         S0302950
C               1 - BUILDING EMISSIONS SOURCE                           S0302960
C               2 - AREA SOURCE                                         S0302970
C        DISP - SOURCE DISPOSITION                                      S0302980
C               0 - ADD SOURCE TO SOURCE INVENTORY AND CALCULATE        S0302990
C                   CONCENTRATION                                       S0303000
C               IF DISP IS NON-ZERO THE PROGRAM ASSUMES THERE IS AN INPUT S0303010
C               TAPE AND NUMSO ON THIS CARD MUST COORESPOND TO A SOURCE S0303020
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C             ON THE INPUT TAPE. ALSO, IF ANY PARAMETER OTHER THAN SOURCES0303040
C             STRENGTH IS TO BE CHANGED FOR AN INCOMING TAPE SOURCE ALL   S0303050
C             PARAMETERS MUST BE REPUNCHED USING A DISP = 0 AND THE       S0303060
C             SOURCE WILL BE REPLACED BY THE NEW SOURCE.                  S0303070
C             1 - USE THE SOURCE STRENGTH ONLY ON THIS CARD TO RESCALE    S0303080
C                 CONCENTRATIONS. IF JFLG IS NON-ZERO THE NEW SOURCE      S0303090
C                 STRENGTHS ARE READ FROM CARD GROUP 11A.                 S0303100
C             2 - DELETE SOURCE NUMSO AND CONCENTRATIONS FROM INVENTORY   S0303110
C      JFLG - IF = 0 SOURCE STRENGTH Q IS CONSTANT AND THE VALUE ON THIS S0303120
C                   CARD IS USED FOR ALL HOURS.                           S0303130
C             IF = 1 SOURCE STRENGTH Q VARIES WITH EACH HOUR OF INPUT     S0303140
C                   DATA. THE Q'S ARE READ WITH THEIR RESPECTIVE SOURCE   S0303150
C                   NUMBER (NUMSQ) AFTER EACH OCCURRENCE OF CARD GROUP    S0303160
C                   11. NOTE THAT TS AND VOL FOR STACKS CAN ALSO VARY     S0303170
C                   WITH Q. SEE END OF CARD GROUP 11.                     S0303180
C      Q - SOURCE STRENGTH IN MASS PER UNIT TIME (GRAMS/SEC). IF JFLG=0  S0303190
C          THIS VALUE MUST BE PUNCHED OR IF JFLG IS NON-ZERO A VALUE OF  S0303200
C          Q FOR EACH MET OBSERVATION IS INPUT VIA CARD GROUP 11A. NOTE  S0303210
C          THAT ZERO IS A VALID SOURCE STRENGTH.                          S0303220
C      DX - X COORDINATE OF CENTER OF SOURCE (METERS)                     S0303230
C      DY - Y COORDINATE OF CENTER OF SOURCE (METERS)                     S0303240
C      H - HEIGHT OF SOURCE ABOVE GROUND (METERS)                         S0303250
C      HS - ELEVATION AT SOURCE BASE (METERS)                             S0303260
C      TS - IF TYPE =0 THEN TS IS SOURCE TEMPERATURE (DEGREES KELVIN)     S0303270
C           IF TS IS LESS THAN OR EQUAL TO ZERO, THE ABSOLUTE VALUE OF TSS0303280
C           PLUS THE AMBIENT AIR TEMP TA IS USED. OTHERWISE TS MUST BE    S0303290
C           GREATER THAN OR EQUAL TO TA. IF JFLG IS NON-ZERO TS MAY VARY S0303300
C           WITH SOURCE STRENGTH IN CARD GROUP 11A BELOW.                 S0303310
C           IF TYPE =1 OR 2 THEN TS IS S1 THE LENGTH OF THE SHORT SIDE    S0303320
C              OF THE RECTANGLE REPRESENTING THE BUILDING OR AREA (MTRS) S0303330
C      VOL - IF TYPE =0 THEN VOL IS THE VOLUMETRIC EMISSION RATE          S0303340
C            (PI*CUBIC METERS/SEC OR ACMS). IF JFLG IS NON-ZERO VOL MAY  S0303350
C            VARY WITH SOURCE STRENGTH IN CARD GROUP 11A BELOW.           S0303360
C            IF TYPE =1 OR 2 THEN VOL IS S2 THE LENGTH OF THE LONG SIDE   S0303370
C               OF THE RECTANGLE REPRESENTING THE BUILDING OR AREA        S0303380
C               (METERS) (S2 SHOULD BE LESS THAN OR EQUAL TO 2*S1)        S0303390
C      DTH - ANGLE CLOCKWISE FROM 0 DEGREES NORTH TO S2 THE LONG SIDE OF S0303400
C            THE AREA OR BUILDING (DEGREES, TYPE = 1 OR 2 ONLY)          S0303410
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C     RDS  - INTERIOR STACK RADIUS FOR ELEVATED SOURCES (METERS). THIS  S0303420
C            PARAMETER IS USED TO CALCULATE THE STACK EXIT VELOCITY FOR S0303430
C            USE IN EQUATION (2-5) OF THE USERS MANUAL, WHICH ADJUSTS   S0303440
C            THE CALCULATED PLUME RISE TO ACCOUNT FOR DOWNWASH EFFECTS  S0303450
C            WHEN THE WIND SPEED AT STACK HEIGHT APPROACHES OR EXCEEDS  S0303460
C            THE STACK EXIT VELOCITY.                                   S0303470
C                PLUME RISE = DELH   ; IF RDS = 0                       S0303480
C                          OR                                           S0303490
C                PLUME RISE = DELH*F ; IF RDS > 0                       S0303500
C                        F = 1             ; IF V/U >= 1.5              S0303510
C                        F = 0             ; IF V/U <= 1.0              S0303520
C                        F = 3*(1.0-U/V) ; IF 1 < V/U < 1.5             S0303530
C                WHERE U = WIND SPEED AT H AND V = EXIT VELOCITY.       S0303540
C     NS - THE NUMBER OF SETTLING VELOCITIES IN PARTICLE DISTRIBUTION   S0303550
C          FOR THE CALCULATION OF PARTICULATES                          S0303560
C-CARD GROUP 10 IS NOT READ IF NS=0                                     S0303570
C-CARD GROUP 10                                                         S0303580
C     (8F10.0) FORMAT                                                   S0303590
C     VS - SETTLING VELOCITY DISTRIBUTION (METERS/SEC)                  S0303600
C     FREQ - FREQUENCY OF OCCURRENCE OF EACH SETTLING VELOCITY VS       S0303610
C-CARD GROUP 11 (IF KSJ =1 OR =3 THIS CARD GROUP IS NOT READ, BUT TAKEN S0303620
C                FROM THE INPUT TAPE. IF NO INPUT TAPE IS USED THIS CARDS0303630
C                GROUP IS READ NHOURS TIMES FOR EACH OF THE NDAYS CASES.S0303640
C     (I4,F7.0,F8.0,F9.0,F7.0,F5.0,A1,F4.0,4F8.0,F3.0) FORMAT           S0303650
C         *- METEOROLOGICAL DATA - EACH CARD REPRESENTS ISW(1) HOURS OF S0303660
C         *- DATA                                                       S0303670
C     HOUR - HOUR OF DAY (RANGE = 00 TO 23, OR 0000 TO 2300 HOURS)      S0303680
C     THETA - WIND DIRECTION  (DEGREES)                                 S0303690
C     UBAR - WIND SPEED (METERS/SEC)                                    S0303700
C     HM - MIXING LAYER DEPTH (METERS)                                  S0303710
C     TA - AMBIENT AIR TEMPERATURE (DEGREES KELVIN)                     S0303720
C     DPDZ - VERTICAL GRADIENT OF POTENTIAL TEMPERATURE (DEGREES KELVIN/S0303730
C            METER)                                                     S0303740
C     ISTBLE - STABILITY CATEGORY A,B,C,D,E,F IF DEFAULT VALUES OF P,   S0303750
C               SIGEPU,SIGAPU,SIGEPL OR SIGAPL ARE TO BE USED           S0303760
C     P - WIND PROFILE POWER LAW EXPONENT (IF EQUAL TO BLANK OR ZERO THES0303770
C         PROGRAM USES :        - WIND SPEED (MPS) -                    S0303780
C         STAB./<=1.54 1.55-3.08 3.09-5.14 5.15-8.23 8.24-10.81 >10.81  S0303790
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C               A    .10      .10      .10      .10      .10      .10      S0303800
C               B    .15      .10      .10      .10      .10      .10      S0303810
C               C    .20      .15      .10      .10      .10      .10      S0303820
C               D    .25      .20      .15      .10      .10      .10      S0303830
C               E    .30      .25      .20      .15      .10      .10      S0303840
C               F    .40      .30      .20      .15      .10      .10      S0303850
C     SIGEPU - STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR        S0303860
C                A - IF ISW(16) = 0 ALL SOURCES.                          S0303870
C                B - IF ISW(16) = 1 STACK (TYPE=0) SOURCES ONLY.          S0303880
C              DEFAULTS ARE PROVIDED ONLY IF ISW(16)=0 AND DEPEND ON      S0303890
C              STABILITY (ISTBLE) AND URBAN OR RURAL MODE. DEFAULT        S0303900
C              VALUES ARE SHOWN UNDER ISW(17). IF SIGEPU IS GREATER THANS0303910
C              OR EQUAL TO 1.0 THE PROGRAM ASSUMES DEGREES, IF LESS THANS0303920
C              1.0 RADIANS.                                               S0303930
C     SIGAPU - STANDARD DEVIATION OF THE WIND DIRECTION ANGLE FOR        S0303940
C                A - IF ISW(16) = 0 ALL SOURCES.                          S0303950
C                B - IF ISW(16) = 1 STACK (TYPE=0) SOURCES ONLY.          S0303960
C              DEFAULTS ARE PROVIDED ONLY IF ISW(16)=0 AND DEPEND ON      S0303970
C              STABILITY (ISTBLE) AND URBAN OR RURAL MODE. DEFAULT        S0303980
C              VALUES ARE SHOWN UNDER ISW(17). IF SIGAPU IS GREATER THANS0303990
C              OR EQUAL TO 1.0 THE PROGRAM ASSUMES DEGREES, IF LESS THANS0304000
C              1.0 RADIANS.                                               S0304010
C     SIGEPL - STANDARD DEVIATION OF THE WIND ELEVATION ANGLE IN DEGREESS0304020
C              OR RADIANS FOR BUILDING (TYPE=1) AND AREA (TYPE=2)         S0304030
C              SOURCES ONLY WHEN ISW(16) = 1. NO DEFAULTS ARE PROVIDED.  S0304040
C     SIGAPL - STANDARD DEVIATION OF THE WIND DIRECTION ANGLE IN DEGREESS0304050
C              OR RADIANS FOR BUILDING (TYPE=1) AND AREA (TYPE=2)         S0304060
C              SOURCES ONLY WHEN ISW(16) = 1. NO DEFAULTS ARE PROVIDED.  S0304070
C     ALPHA - LATERAL DIFFUSION COEFFICIENT (IF BLANK OR 0 PROGRAM       S0304080
C             ASSUMES .9)                                                 S0304090
C-CARD GROUP 11A (THIS CARD GROUP IS ONLY INPUT IF ONE OR MORE OF THE    S0304100
C              INPUT CARD SOURCES HAS JFLG SET NON-ZERO. THIS CARD       S0304110
C              GROUP FOLLOWS EACH OCCURRENCE OF CARD GROUP 11 IN         S0304120
C              THE INPUT DECK)                                            S0304130
C     (I6,3F10.0) FORMAT                                                  S0304140
C     NUMSQB - SOURCE NUMBER OF SOURCE WITH VARIABLE EMISSIONS.           S0304150
C     QB - SOURCE STRENGTH (SAME UNITS AS Q) FOR THIS HOUR OR MET        S0304160
C          OBSERVATION FOR SOURCE NUMSQB.                                 S0304170
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C     TSB - SOURCE TEMPERATURE (DEG K) PLUS 10000.0 FOR THIS HOUR FOR   S0304180
C           TYPE 0 SOURCES ONLY WITH JFLG NON-ZERO. REMEMBER TO ADD     S0304190
C           10000.0 TO THE INPUT TEMPERATURE IF INPUT. IF THIS VALUE IS S0304200
C           LEFT BLANK OR ZERO IS PUNCHED THE PROGRAM USES TS FROM CARD S0304210
C           GROUP 9A.                                                   S0304220
C     VOLB - SOURCE VOLUMETRIC EMISSION RATE PLUS 10000.0 FOR THIS HOUR S0304230
C            FOR TYPE 0 SOURCES ONLY WITH JFLG NON-ZERO. REMEMBER TO    S0304240
C            ADD 10000.0 TO THE INPUT VALUE IF USED. IF THIS VALUE IS   S0304250
C            LEFT BLANK OR ZERO IS PUNCHED THE PROGRAM USES VOL FROM    S0304260
C            CARD GROUP 9A.                                             S0304270
C                                                                       S0304280
C                                                                       S0304290
C-**********************************************************************S0304300
C                                                                       S0304310
C********************************************************************** S0304320
C                                                                       S0304330
      INTEGER TITLE,TYPE,HOUR,DATS,SFMT,DISP                            S0304340
C                                                                       S0304350
      DIMENSION S1(100),S2(100),SIGEL(6),SIGAL(6),SIGEU(6),SIGAU(6),    S0304360
     1PP(6,6),IST(6),NSOGRP(1000),IDSOR(1000),IMSOR(1000),IARRY(1000),  S0304370
     2NSW(20),SFMT(20),SPCAT(5),X(1),Y(1),CON(NXXYY,5),ZZ(1),ICONST(9) S0304380
C                                                                       S0304390
      COMMON /DIM/ NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NHOURS,NDAYS      S0304400
     1,IOVRSN                                                           S0304410
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0304420
      COMMON /FP1/ ROTATE,TK,G,ZR,HA,GAMMA1,GAMMA2,XRY,DECAY            S0304430
     1,UTMX,UTMY                                                        S0304440
      COMMON /MET/ THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,SIGAPU,SIGEPL, S0304450
     1SIGAPL,ALPHA,HOUR,NUMSOB(MKQ),QB(MKQ),TSB(MKQ),VOLB(MKQ)          S0304460
      COMMON /SOR/ NUMSQ(MKQ),TYPE(MKQ),Q(MKQ),DX(MKQ),DY(MKQ),H(MKQ),  S0304470
     1HS(MKQ),TS(MKQ),VOL(MKQ),DTH(MKQ),RDS(MKQ),NS(MKQ),VS(10,MKQ),    S0304480
     2FREQ(10,MKQ),JFLG(MKQ),H10(MKQ),H10SQ(MKQ),VSQ(MKQ),W(MKQ)        S0304490
     3,IFTAP(MKQ),CHGQ(MKQ)                                             S0304500
      COMMON /RST/ ISW(20),TITLE(20),KUNR(5),KFVR(3),DD1(3),I3,DATS(2), S0304510
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0304520
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0304530
      COMMON /ERF/ W2,W3                                                S0304540
C                                                                       S0304550
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      EQUIVALENCE (S1(1),TS(1)),(S2(1),VOL(1)),(NSOURC,DMYNSO),
     1(ISW(1),DMYISW),(NUMSQ(1),DMYNSQ)                                 S0304560
C                                                                       S0304570
      DATA IX/1HX/,SFMT/4H(I5,,4H3I1,,4HF10.,4H0,8F,4H7.0,,3HI2),14*1H /S0304580
      DATA SIGEL/2*.1745,.1090,.0735,2*.0465/,SIGEU/.1745,.1080,.0735,.0S0304590
     1465,.035,.0235/,SIGAU/.2495,.1544,.1051,.0665,.0501,.0336/,SIGAL/2S0304600
     2*.2495,.1544,.1051,2*.0665/,PP/6*.1,.15,5*.1,.2,.15,4*.1,.25,.2,.1S0304610
     35,3*.1,.3,.25,.2,.15,2*.1,.4,.3,.2,.15,2*.1/,IST/1HA,1HB,1HC,1HD,1S0304620
     4HE,1HF/,RADIAN/.01745329/,ICOM/1H,/,                              S0304630
     5SPCAT/1.5444,3.0987,5.1479,8.2366,10.8106/                        S0304640
      DATA ICONST/4H(MIC,4HROGR,4HAMS/,4HCUBI,4HC ME,4HTER),4H(GRA,     S0304650
     14HMS/S,4HEC) /                                                    S0304660
C                                                                       S0304670
C                  *-* START PROGRAM *-*                                S0304680
C                                                                       S0304690
C     COMPRESS DATE INTO 6 LEFT JUSTIFIED CHARACTERS                    S0304700
C     DATS(1) CONTAINS MMOD, DATS(2) CONTAINS YY--                      S0304710
      CALL ADATE(DATS(1),IPRT(32))                                      S0304720
C     SET NUMBER OF LINES PER PAGE                                      S0304730
      NLINES = 57                                                       S0304740
      IF (NSOURC .EQ. 0.AND.KSW .EQ. 0) NSOURC = 1                      S0304750
      IF (NSOURC .EQ. 0.AND.KSW .EQ. 2) NSOURC = 1                      S0304760
      IF (NHOURS .LT. 1) NHOURS = 24                                    S0304770
      IF (NDAYS .LT. 1)  NDAYS  = 1                                     S0304780
      IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 110                          S0304790
      DO 10 I=1,9                                                       S0304800
   10 NUMSQ(I) = KUNR(I)                                                S0304810
C     READ TAPE BUFFER, 49 WORDS INTO ISW                               S0304820
      CALL INPOUP(-1,DMYISW,49)                                         S0304830
      IF (NUMSQ(1) .EQ. IBLNK) GO TO 30                                 S0304840
      DO 20 I=1,6                                                       S0304850
   20 KUNR(I) = NUMSQ(I)                                                S0304860
   30 CONTINUE                                                          S0304870
      DO 40 I=1,8                                                       S0304880
      IF (IPRT(I) .NE. IBLNK) GO TO 50                                  S0304890
   40 CONTINUE                                                          S0304900
      GO TO 70                                                          S0304910
   50 DO 60 I=1,20                                                      S0304920
                                                                        S0304930
   60 TITLE(I) = IPRT(I)                                                S0304940
   70 CONTINUE                                                          S0304950
   80 IF (NUMSQ(7) .EQ. IBLNK) GO TO 100                                S0304960
      DO 90 I=1,3                                                       S0304970
   90 KFNR(I) = NUMSQ(I+6)                                              S0304980
  100 CONTINUE                                                          S0304990
      IF (NOGO .GT. 0) GO TO 2410                                       S0305000
      READ (IUNT,9003) NSW                                              S0305010
      ISW(2) = NSW(2)                                                   S0305020
      ISW(8) = NSW(8)                                                   S0305030
      ISW(3) = NSW(3)                                                   S0305040
      ISW(4) = NSW(4)                                                   S0305050
      ISW(5) = NSW(5)                                                   S0305060
      ISW(6) = NSW(6)                                                   S0305070
      ISW(10) = NSW(10)                                                 S0305080
      ISW(12) = NSW(12)                                                 S0305090
      GO TO 120                                                         S0305100
  110 CONTINUE                                                          S0305110
      READ (IUNT,9003) ISW                                              S0305120
  120 CONTINUE                                                          S0305130
C     SET PRINTOUT LOGICAL UNIT NUMBER (JUNT=ISW(10)).                  S0305140
      IF (ISW(10) .GT. 0) JUNT = ISW(10)                                S0305150
      DO 130 I=1,6                                                      S0305160
      IF (KUNR(I) .NE. IBLNK) GO TO 140                                 S0305170
  130 CONTINUE                                                          S0305180
      KUNR(1) = ICONST(1)                                               S0305190
      KUNR(2) = ICONST(2)                                               S0305200
      KUNR(3) = ICONST(3)                                               S0305210
      KUNR(4) = ICONST(4)                                               S0305220
      KUNR(5) = ICONST(5)                                               S0305230
      KUNR(6) = ICONST(6)                                               S0305240
  140 CONTINUE                                                          S0305250
      IF (KFNR(1) .NE. IBLNK.OR.KFNR(2) .NE. IBLNK) GO TO 150           S0305260
      KFNR(1) = ICONST(7)                                               S0305270
      KFNR(2) = ICONST(8)                                               S0305280
      KFNR(3) = ICONST(9)                                               S0305290
  150 CONTINUE                                                          S0305300
      NXYPTS = NXPNTS+NYPNTS                                            S0305310
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            NIJ = NXPNTS+NYPNTS
            NJI = NYPNTS+NXWYPT                                                   S0305320
            IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 160                              S0305330
C           READ TAPE BUFFER, NIJ+2*NXWYPT WORDS INTO X                           S0305340
            CALL INPOUP(1,X,NIJ+2*NXWYPT)                                         S0305350
            IF (NOGO .GT. 0) GO TO 2410                                           S0305360
            GO TO 280                                                             S0305370
        160 IF (NXPNTS .LE. 0) GO TO 210                                          S0305380
            J = 8                                                                 S0305390
            IF (J .GT. NXPNTS) J = NXPNTS                                         S0305400
            DO 170 I=1,J                                                          S0305410
        170 X(I) = 0.0                                                            S0305420
            READ (IUNT,9001) (X(I),I=1,J)                                         S0305430
            IF (NXPNTS .LE. 3) GO TO 210                                          S0305440
            DO 180 I=3,J                                                          S0305450
            IF (X(I)) 200,180,200                                                 S0305460
        180 CONTINUE                                                              S0305470
            A1 = X(2)                                                             S0305480
            DO 190 I=2,NXPNTS                                                     S0305490
        190 X(I) = X(I-1)+A1                                                      S0305500
            GO TO 210                                                             S0305510
        200 IF (NXPNTS .LE. 8) GO TO 210                                          S0305520
            READ (IUNT,9001) (X(I),I=9,NXPNTS)                                    S0305530
        210 IF (NXWYPT .LE. 0) GO TO 220                                          S0305540
            READ (IUNT,9001) (X(NIJ+I),I=1,NXWYPT)                                S0305550
        220 IF (NYPNTS .LE. 0) GO TO 270                                          S0305560
            J = 8                                                                 S0305570
            IF (J .GT. NYPNTS) J = NYPNTS                                         S0305580
            DO 230 I=1,J                                                          S0305590
        230 Y(I) = 0.0                                                            S0305600
            READ (IUNT,9001) (Y(I),I=1,J)                                         S0305610
            IF (NYPNTS .LE. 3) GO TO 270                                          S0305620
            DO 240 I=3,J                                                          S0305630
            IF (Y(I)) 260,240,260                                                 S0305640
        240 CONTINUE                                                              S0305650
            A1 = Y(2)                                                             S0305660
            DO 250 I=2,NYPNTS                                                     S0305670
        250 Y(I) = Y(I-1)+A1                                                      S0305680
                                                                                  S0305690
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          GO TO 270                                                     S0305700
  260     IF (NYPNTS .LE. 8) GO TO 270                                  S0305710
          READ (IUNT,9001) (Y(I),I=9,NYPNTS)                            S0305720
  270     IF (NXWYPT .LE. 0) GO TO 290                                  S0305730
          READ (IUNT,9001) (Y(NJI+I),I=1,NXWYPT)                        S0305740
  280     CONTINUE                                                      S0305750
  290     CONTINUE                                                      S0305760
          IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 300                      S0305770
C         READ TAPE BUFFER, NXXYY WORDS INTO ZZ                         S0305780
          CALL INPOUP(1,ZZ,NXXYY)                                       S0305790
          IF (NOGO .GT. 0) GO TO 2410                                   S0305800
          GO TO 330                                                     S0305810
  300     CONTINUE                                                      S0305820
          IF (ISW(7) .EQ. 0) GO TO 330                                  S0305830
          IF (NYPNTS .LE. 0) GO TO 320                                  S0305840
          DO 310 J=1,NYPNTS                                             S0305850
          N = (J-1)*NXPNTS                                              S0305860
  310     READ (IUNT,9001) (ZZ(N+I),I=1,NXPNTS)                         S0305870
          IF (NXWYPT .LE. 0) GO TO 330                                  S0305880
  320     READ (IUNT,9001) (ZZ(NXYPTS+I),I=1,NXWYPT)                    S0305890
  330     CONTINUE                                                      S0305900
          IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 340                      S0305910
C         READ TAPE BUFFER, 11 WORDS INTO ROTATE                        S0305920
          CALL INPOUP(1,ROTATE,11)                                      S0305930
          IF (NOGO .GT. 0) GO TO 2410                                   S0305940
          GO TO 350                                                     S0305950
  340     CONTINUE                                                      S0305960
          READ (IUNT,9004) ROTATE,TK,HA,UTMX,UTMY,G,ZR,GAMMA1,GAMMA2,DECAY, S0305970
         1XRY                                                           S0305980
  350     CONTINUE                                                      S0305990
C         PROVIDE DEFAULT VALUES                                        S0306000
          IF (ISW(1) .LE. 0) ISW(1) = 1                                 S0306010
          IF (ISW(2) .GT. 0) ISW(2) = ISW(1)                            S0306020
          IF (TK .LE. 0.0) TK = 1.0E6                                   S0306030
          IF (G .LE. 0.0) G = 9.8                                       S0306040
          IF (ZR .LE. 0.0) ZR = 6.096                                   S0306050
          IF (GAMMA1 .LE. 0.0) GAMMA1 = 0.6                             S0306060
          IF (GAMMA2 .LE. 0.0) GAMMA2 = 0.66                            S0306070
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      IF (XRY .LE. 0.0) XRY = 50.0                                      S0306080
C     INPUT CONCENTRATION REPORTS DESIRED                               S0306090
      IF (NGROUP .LE. 0) GO TO 370                                      S0306100
      READ (IJNT,9003) (NSOGRP(I),I=1,NGROUP)                           S0306110
      LSQ = 0                                                           S0306120
      DO 360 I=1,NGROUP                                                 S0306130
  360 LSQ = LSQ+NSOGRP(I)                                               S0306140
      READ (IJNT,9002) (IDSOR(I),I=1,LSQ)                               S0306150
  370 CONTINUE                                                          S0306160
C     IS INPUT DATA LISTING DESIRED                                     S0306170
      IF (ISW(6) .EQ. 0.OR.ISW(6) .EQ. 2) GO TO 420                     S0306180
      LINE = NLINES                                                     S0306190
      CALL TITLR(0,33,1)                                                S0306200
      WRITE (JUNT,9007) NSOURC,NXPNTS,NYPNTS,NHOURS,NDAYS,NGROUP,NXWYPT S0306210
      WRITE (JUNT,9008) (ISW(I),I=1,5),ISW(7),ISW(9),ISW(11)            S0306220
      WRITE (JUNT,9038) (ISW(I),I=12,17)                                S0306230
      WRITE (JUNT,9009) TK,G,ZR,GAMMA1,GAMMA2,XRY,DECAY,ROTATE          S0306240
      WRITE (JUNT,9022) HA,UTMX,UTMY                                    S0306250
      IF (NXPNTS .LE. 0) GO TO 380                                      S0306260
      CALL TITLR(1,4+NXPNTS/8,1)                                        S0306270
      WRITE (JUNT,9010) (X(I),I=1,NXPNTS)                               S0306280
      K = 1                                                             S0306290
      IF (ISW(13) .NE. 0) K = 3                                         S0306300
      CALL TITLR(1,4+NYPNTS/8,1)                                        S0306310
      WRITE (JUNT,9011) MUNT(K),MUNT(K+1),(Y(J),J=1,NYPNTS)             S0306320
  380 IF (NXWYPT .LE. 0) GO TO 390                                      S0306330
      K = 1                                                             S0306340
      IF (ISW(14) .NE. 0) K = 3                                         S0306350
      CALL TITLR(1,4+NXWYPT/5,1)                                        S0306360
      WRITE (JUNT,9019) MUNT(K),MUNT(K+1),(X(NIJ+I),Y(NJI+I),I=1,NXWYPT)S0306370
  390 CONTINUE                                                          S0306380
      IF (NGROUP .LE. 0) GO TO 400                                      S0306390
      CALL TITLR(1,6,1)                                                 S0306400
      WRITE (JUNT,9012) NGROUP,(NSOGRP(I),I=1,NGROUP)                   S0306410
      WRITE (JUNT,9013) (IDSOR(I),I=1,LSQ)                              S0306420
  400 CONTINUE                                                          S0306430
      IF (ISW(7) .EQ. 0) GO TO 410                                      S0306440
      J = 99                                                            S0306450
      CALL OUTPT(J,K,X,Y,ZZ)                                            S0306460
  410 CONTINUE                                                          S0306470
  420 CONTINUE                                                          S0306480
C     INPUT FORMAT FOR SOURCE CARDS                                     S0306490
      IF (ISW(12) .NE. 0) READ (IUNT,9005) SFMT                         S0306500
      LINE = NLINES                                                     S0306510
      ITC = 0                                                           S0306520
C     INPUT ALL SOURCES                                                 S0306530
      KFLG = 0                                                          S0306540
      IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 440                          S0306550
C     READ TAPE BUFFER, 33*MKQ WORDS INTO NUMSQ                         S0306560
      CALL INPOUP(1,DMYNSQ,33*MKQ)                                      S0306570
      IF (NOGO .GT. 0) GO TO 2410                                       S0306580
      DO 430 I=1,NGROPS                                                 S0306590
      IF (JFLG(I) .GT. 0) KFLG = KFLG+1                                 S0306600
      IF (JFLG(I) .GT. 0) JFLG(I) = 2                                   S0306610
      IFTAP(I) = I                                                      S0306620
  430 CHGQ(I) = -1.0                                                    S0306630
      IF (NSOURC .LE. 0) GO TO 630                                      S0306640
  440 DO 620 L=1,NSOURC                                                 S0306650
      READ (IUNT,SFMT) NUMSQ(MKQ),TYPE(MKQ),DISP,JFLG(MKQ),Q(MKQ),DX(MKQS0306660
     1),DY(MKQ),H(MKQ),HS(MKQ),TS(MKQ),VOL(MKQ),DTH(MKQ),RDS(MKQ),NS(MKQS0306670
     2)                                                                 S0306680
      IF (NS(MKQ) .LE. 0) GO TO 450                                     S0306690
      NSS = NS(MKQ)                                                     S0306700
      READ (IUNT,9001) (VS(N,MKQ),FREQ(N,MKQ),N=1,NSS)                  S0306710
  450 CONTINUE                                                          S0306720
      J = 0                                                             S0306730
  460 J = J+1                                                           S0306740
      IF (J .GT. NGROPS) GO TO 470                                      S0306750
      IF (NUMSQ(MKQ) .GT. NUMSQ(J)) GO TO 460                           S0306760
      IF (NUMSQ(J) .EQ. NUMSQ(MKQ)) GO TO 530                           S0306770
      IF (NUMSQ(MKQ) .LT. NUMSQ(J)) GO TO 500                           S0306780
  470 IF (DISP .EQ. 0) GO TO 480                                        S0306790
      WRITE (JUNT,9032) NUMSQ(MKQ)                                      S0306800
      GO TO 2410                                                        S0306810
  480 NGROPS = NGROPS+1                                                 S0306820
      IFTAP(J) = 0                                                      S0306830
  490 CHGQ(J) = -1.0                                                  S0306340
  500 NUMSQ(J) = NUMSQ(MKQ)                                           S0306350
      TYPE(J) = TYPE(MKQ)                                             S0306360
      Q(J) = Q(MKQ)                                                   S0306370
      DX(J) = DX(MKQ)                                                 S0306380
      DY(J) = DY(MKQ)                                                 S0306390
      H(J) = H(MKQ)                                                   S0306900
      HS(J) = HS(MKQ)                                                 S0306910
      TS(J) = TS(MKQ)                                                 S0306920
      VOL(J) = VOL(MKQ)                                               S0306930
      DTH(J) = DTH(MKQ)                                               S0306940
      RDS(J) = RDS(MKQ)                                               S0306950
      JFLG(J) = JFLG(MKQ)                                             S0306960
      NS(J) = NS(MKQ)                                                 S0306970
      DO 510 I=1,10                                                   S0306980
      VS(I,J) = 0.0                                                   S0306990
  510 FREQ(I,J) = 0.0                                                 S0307000
      IF (NS(J) .LE. 0.0) GO TO 620                                   S0307010
      NSS = NS(J)                                                     S0307020
      DO 520 I=1,NSS                                                  S0307030
      VS(I,J) = VS(I,MKQ)                                             S0307040
  520 FREQ(I,J) = FREQ(I,MKQ)                                         S0307050
      GO TO 620                                                       S0307060
  530 IFTAP(J) = -IFTAP(J)                                            S0307070
      IF (DISP .EQ. 0) GO TO 490                                      S0307080
      IF (DISP .NE. 1) GO TO 580                                      S0307090
      IF (JFLG(MKQ) .GT. 0) GO TO 560                                 S0307100
      IF (JFLG(J) .GT. 0) GO TO 550                                   S0307110
      IF (Q(J) .EQ. 0.0) GO TO 540                                    S0307120
      CHGQ(J) = Q(MKQ)/Q(J)                                           S0307130
      Q(J) = Q(MKQ)                                                   S0307140
      GO TO 620                                                       S0307150
  540 Q(J) = Q(MKQ)                                                   S0307160
      CHGQ(J) = -1.0                                                  S0307170
      GO TO 620                                                       S0307180
  550 Q(J) = Q(MKQ)                                                   S0307190
      CHGQ(J) = -3.0                                                  S0307200
      GO TO 620                                                       S0307210
  560 IF (JFLG(J) .GT. 0) GO TO 570                                 S0307220
      JFLG(J) = 1                                                   S0307230
      CHGQ(J) = -4.0                                                S0307240
      GO TO 620                                                     S0307250
  570 CHGQ(J) = -2.0                                                S0307260
      GO TO 620                                                     S0307270
  580 I = J+1                                                       S0307280
      DO 590 K=I,NGROPS                                             S0307290
      NUMSQ(K-1) = NUMSQ(K)                                         S0307300
      TYPE(K-1) = TYPE(K)                                           S0307310
      Q(K-1) = Q(K)                                                 S0307320
      DX(K-1) = DX(K)                                               S0307330
      DY(K-1) = DY(K)                                               S0307340
      H(K-1) = H(K)                                                 S0307350
      HS(K-1) = HS(K)                                               S0307360
      TS(K-1) = TS(K)                                               S0307370
      VOL(K-1) = VOL(K)                                             S0307380
      DTH(K-1) = DTH(K)                                             S0307390
      RDS(K-1) = RDS(K)                                             S0307400
      JFLG(K-1) = JFLG(K)                                           S0307410
      NS(K-1) = NS(K)                                               S0307420
      IFTAP(K-1) = IFTAP(K)                                         S0307430
      CHGQ(K-1) = CHGQ(K)                                           S0307440
      DO 590 N=1,10                                                 S0307450
      VS(N,K-1) = VS(N,K)                                           S0307460
      FREQ(N,K-1) = FREQ(N,K)                                       S0307470
  590 CONTINUE                                                      S0307480
      NGROPS = NGROPS-1                                             S0307490
      GO TO 620                                                     S0307500
  600 IF (DISP .NE. 0) GO TO 470                                    S0307510
      M = NGROPS+1                                                  S0307520
      DO 610 I=J,NGROPS                                             S0307530
      M = M-1                                                       S0307540
      NUMSQ(M+1) = NUMSQ(M)                                         S0307550
      TYPE(M+1) = TYPE(M)                                           S0307560
      Q(M+1) = Q(M)                                                 S0307570
      DX(M+1) = DX(M)                                               S0307580
      DY(M+1) = DY(M)                                               S0307590
      H(M+1) = H(M)                                                     S0307600
      HS(M+1) = HS(M)                                                   S0307610
      TS(M+1) = TS(M)                                                   S0307620
      VOL(M+1) = VOL(M)                                                 S0307630
      DTH(M+1) = DTH(M)                                                 S0307640
      RDS(M+1) = RDS(M)                                                 S0307650
      JFLG(M+1) = JFLG(M)                                               S0307660
      NS(M+1) = NS(M)                                                   S0307670
      IFTAP(M+1) = IFTAP(M)                                             S0307680
      CHGQ(M+1) = CHGQ(M)                                               S0307690
      DO 610 N=1,10                                                     S0307700
      VS(N,M+1) = VS(N,M)                                               S0307710
      FREQ(N,M+1) = FREQ(N,M)                                           S0307720
  610 CONTINUE                                                          S0307730
      GO TO 480                                                         S0307740
  620 CONTINUE                                                          S0307750
  630 NSOURC = NGROPS                                                   S0307760
      IF (KSW .LT. 2) GO TO 640                                         S0307770
C     WRITE TAPE BUFFER, 8 WORDS FROM NSOURC                            S0307780
      CALL INPOUP(2,DMYNSO,9)                                           S0307790
      IF (NOGO .GT. 0) GO TO 2410                                       S0307800
C     WRITE TAPE BUFFER, 49 WORDS FROM ISW                              S0307810
      CALL INPOUP(2,DMYISW,49)                                          S0307820
      IF (NOGO .GT. 0) GO TO 2410                                       S0307830
C     WRITE TAPE BUFFER, NIJ+2*NXWYPT WORDS FROM X                      S0307840
      CALL INPOUP(2,X,NIJ+2*NXWYPT)                                     S0307850
      IF (NOGO .GT. 0) GO TO 2410                                       S0307860
C     WRITE TAPE BUFFER, NXXYY WORDS FROM ZZ                            S0307870
      CALL INPOUP(2,ZZ,NXXYY)                                           S0307880
      IF (NOGO .GT. 0) GO TO 2410                                       S0307890
C     WRITE TAPE BUFFER, 11 WORDS FROM ROTATE                           S0307900
      CALL INPOUP(2,ROTATE,11)                                          S0307910
      IF (NOGO .GT. 0) GO TO 2410                                       S0307920
C     WRITE TAPE BUFFER, 33*MK9 WORDS FROM NUMSQ                        S0307930
      CALL INPOUP(2,DMYNSQ,33*MKQ)                                      S0307940
      IF (NOGO .GT. 0) GO TO 2410                                       S0307950
  640 MFLG = 0                                                          S0307960
      K = 1                                                             S0307970
      IF (ISW(15) .NE. 0) K = 3                                         S0307980
      IF (ISW(7) .EQ. 0) HA = 0.0                                       S0307990
      DO 750 L=1,NSOURC                                                 S0308000
      IF (JFLG(L) .EQ. 1) MFLG = MFLG+1                                 S0308010
  650 IF (ISW(6) .LE. 1) GO TO 670                                      S0308020
      CALL TITLR(ITC,1+NSS,2)                                           S0308030
      ITC = 1                                                           S0308040
      IF (IPC .EQ. 0) GO TO 660                                         S0308050
      LINE = LINE+8                                                     S0308060
      WRITE (JUNT,9014) KFNR,MUNT(K),MUNT(K+1)                          S0308070
  660 I = IBLNK                                                         S0308080
      J = IBLNK                                                         S0308090
      IF (IFTAP(L) .LE. 0) I = IX                                       S0308100
      IF (IFTAP(L) .NE. 0) J = IX                                       S0308110
      WRITE (JUNT,9015) I,J,NUMSQ(L),TYPE(L),Q(L),DX(L),DY(L),H(L),TS(L)S0308120
     1,VOL(L),DTH(L),RDS(L),HS(L)                                       S0308130
  670 CONTINUE                                                          S0308140
      IF (ISW(7) .GT. 0) GO TO 680                                      S0308150
      HS(L) = 0.0                                                       S0308160
      GO TO 690                                                         S0308170
  680 IF (HS(L) .EQ. 0) GO TO 690                                       S0308180
      HS(L) = 0.0                                                       S0308190
      ISW(7) = 0                                                        S0308200
      WRITE (JUNT,9041)                                                 S0308210
      HA = 0.0                                                          S0308220
  690 CONTINUE                                                          S0308230
      IF (TYPE(L) .NE. 0) GO TO 720                                     S0308240
      IF (IFTAP(L) .GT. 0) GO TO 720                                    S0308250
      IF (RDS(L) .LE. 0.0) GO TO 700                                    S0308260
      W(L) = VOL(L)/(3.1415926*RDS(L)*RDS(L))                           S0308270
      GO TO 710                                                         S0308280
  700 W(L) = 0.0                                                        S0308290
  710 CONTINUE                                                          S0308300
      H10(L) = 10.0*H(L)                                                S0308310
      H10SQ(L) = H10(L)*H10(L)                                          S0308320
      GO TO 730                                                         S0308330
  720 CONTINUE                                                          S0308340
  730 IF (NSS .LE. 0) GO TO 750                                         S0308350
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      IF (ISW(6) .LE. 1) GO TO 740                                      S0308360
      WRITE (JUNT,9016) (VS(N,L),FREQ(N,L),N=1,NSS)                     S0308370
  740 CONTINUE                                                          S0308380
  750 CONTINUE                                                          S0308390
      DO 820 L=1,NSOURC                                                 S0308400
      IF (IFTAP(L) .GT. 0) GO TO 820                                    S0308410
      IF (ISW(15) .EQ. 0) GO TO 760                                     S0308420
      A1 = DY(L)*RADIAN                                                 S0308430
      DY(L) = DX(L)*COS(A1)+UTMY                                        S0308440
      DX(L) = DX(L)*SIN(A1)+UTMX                                        S0308450
  760 CONTINUE                                                          S0308460
      IF (IFTAP(L) .NE. 0) GO TO 770                                    S0308470
      IF (JFLG(L) .NE. 0) JFLG(L) = 1                                   S0308480
      GO TO 800                                                         S0308490
  770 IF (JFLG(L) .EQ. 0) GO TO 800                                     S0308500
      IF (CHGQ(L) .LE. -4.0) GO TO 790                                  S0308510
      IF (CHGQ(L) .LE. -3.0) GO TO 780                                  S0308520
      JFLG(L) = 2                                                       S0308530
      GO TO 800                                                         S0308540
  780 JFLG(L) = 3                                                       S0308550
      GO TO 800                                                         S0308560
  790 JFLG(L) = 4                                                       S0308570
  800 CONTINUE                                                          S0308580
      IF (TYPE(L) .NE. 0) DTH(L) = DTH(L)*RADIAN                        S0308590
      IF (NS(L) .EQ. 0) GO TO 820                                       S0308600
      NSS = NS(L)                                                       S0308610
      DO 810 N=1,NSS                                                    S0308620
  810 FREQ(N,L) = FREQ(N,L)*0.5                                         S0308630
  820 CONTINUE                                                          S0308640
      MSRS = 2                                                          S0308650
C     DEFAULT REPORT                                                    S0308660
      IF (NGROUP .GT. 0) GO TO 830                                      S0308670
      NGROUP = 1                                                        S0308680
      NSOGRP(1) = 1                                                     S0308690
      IDSOR(1) = -NUMSR(NSOURC)                                         S0308700
      LSQ = 1                                                           S0308710
      MSRS = 1                                                          S0308720
  830 CONTINUE                                                          S0308730
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C     DEFINE MASS STORAGE FILE AS UNIT 12                               S0308740
      MSREC = NKXYY                                                     S0308750
C     ADD EXTRA WORD PER RECORD                                         S0308760
      MSREC = MSREC+1                                                   S0308770
      MASREC = NSOURC*NHOURS                                            S0308780
C     SET UP UNIVAC JCL AND ASSIGN MASS STOAGE UNIT 12, NUMBER OF       S0308790
C     RECORDS=MASREC, WORDS PER RECORD=MSREC, L ERROR FLAG IF NEG.,     S0308800
C     JUNT=PRINTER.                                                     S0308810
      CALL ASSIGN(MASREC,MSREC,L,JUNT)                                  S0308820
      IF (L .LT. 0) GO TO 2410                                          S0308830
C     DYNAMICALLY DEFINE MASS STORAGE UNIT 12 AS RANDOM ACCESS -        S0308840
C     NO. OF RECS.=MASREC, NO. WORDS PER REC.=MSREC, 5=BINARY           S0308850
C     UNFORMATTED FILE, IOREC = ASSOCIATE VARIABLE - RECORD POINTER.    S0308860
      CALL DEFFIL(12,MASREC,MSREC,5,IOREC)                              S0308870
C     CALCULATE MET INPUT INCREMENT AND AVERAGING FACTOR                S0308880
      DO 840 I=3,5                                                      S0308890
      IF (ISW(I) .LE. 0) GO TO 840                                      S0308900
      DD1(I-2) = FLOAT(ISW(1))/FLOAT(ISW(I))                            S0308910
  840 CONTINUE                                                          S0308920
C     SET INTERNAL MODEL CONSTANTS                                      S0308930
      B1 = 1.5/(GAMMA1*GAMMA1)                                          S0308940
      ZRI = 1.0/ZR                                                      S0308950
      A1 = G*.318309886                                                 S0308960
      A0 = 1.0/A1                                                       S0308970
      DO 850 L=1,NSOURC                                                 S0308980
      IF (TYPE(L) .GT. 0) GO TO 850                                     S0308990
      IF (IFTAP(L) .GT. 0) GO TO 850                                    S0309000
      H10SQ(L) = H10SQ(L)*B1                                            S0309010
      VOL(L) = VOL(L)*A1                                                S0309020
  850 CONTINUE                                                          S0309030
      C1 = 3.0/(GAMMA2*GAMMA2)                                          S0309040
      E1 = .465116279                                                   S0309050
      D1 = .5*E1                                                        S0309060
      PP1 = TK*.318309886                                               S0309070
      PS1 = TK*.39894229                                                S0309080
      A4 = 1.0/KRY                                                      S0309090
      P1 = 1.253314137                                                  S0309100
      P2 = .707106781                                                   S0309110
      CALL ZRO(CON(1,2),NXXYY)                                          S0309120
      CALL ZRO(CON(1,3),NXXYY)                                          S0309130
      CALL ZRO(CON(1,4),NXXYY)                                          S0309140
C     SET UP SOURCE ID NUMBER, MASS STORAGE RECORD NUMBER RELATIONSHIP  S0309150
      N = 0                                                             S0309160
      DO 990 I=1,NGROUP                                                 S0309170
      K = NSOGRP(I)                                                     S0309180
      DO 980 J=1,K                                                      S0309190
      IMSOR(N+J) = 0                                                    S0309200
      DO 960 L=1,NSOURC                                                 S0309210
      IF (IABS(IDSOR(N+J)).EQ.NUMSQ(L)) GO TO 870                       S0309220
      IF (IABS(IDSOR(N+J)).LT.NUMSQ(L).AND.IDSOR(N+J).LT.0) GO TO 870   S0309230
      IF (IDSOR(N+J) .LT. 0) GO TO 960                                  S0309240
      IF (J.LT.K.AND.IDSOR(N+J).LT.NUMSQ(L).AND.IDSOR(N+J+1).LT.0) GO TOS0309250
     1870                                                               S0309260
  960 CONTINUE                                                          S0309270
      L = NSOURC                                                        S0309280
      IF (IDSOR(N+J).LT.0.AND.IABS(IDSOR(N+J)).GT.NUMSQ(L)) GO TO 870   S0309290
      GO TO 980                                                         S0309300
  870 IMSOR(N+J) = L                                                    S0309310
      IF (IDSOR(N+J) .LT. 0) IMSOR(N+J) = -L                            S0309320
  980 CONTINUE                                                          S0309330
      N = N+K                                                           S0309340
  990 CONTINUE                                                          S0309350
      IF (ISW(14) .EQ. 0.OR.NXWYPT .EQ. 0) GO TO 930                    S0309360
      IF (UTMX) 910,900,910                                             S0309370
  900 IF (UTMY) 910,930,910                                             S0309380
  910 DO 920 I=1,NXWYPT                                                 S0309390
      S = Y(I+NJI)*RADIAN                                               S0309400
      Y(I+NJI) = X(I+NIJ)*COS(S)+UTMY                                   S0309410
  920 X(I+NIJ) = X(I+NIJ)*SIN(S)+UTMX                                   S0309420
      ISW(14) = 0                                                       S0309430
  930 CONTINUE                                                          S0309440
C                                                                       S0309450
C-+*********************************************************************S0309460
C     BEGIN MAIN LOOP OVER DAYS OR CASES                                S0309470
      DO 2390 ND=1,NDAYS                                                S0309480
C     INITIALIZE MASS STORAGE RECORD POINTER                            S0309490
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      JOREC = 0                                                         S0309500
      LINE = NLINES+1                                                   S0309510
      I3 = 0                                                            S0309520
      ITC = 0                                                           S0309530
C                                                                       S0309540
C-**********************************************************************S0309550
C     BEGIN MAIN LOOP OVER HOURS                                        S0309560
      DO 2200 IH=1,NHOURS                                               S0309570
      I3 = I3+ISW(1)                                                    S0309580
      IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 940                          S0309590
C     READ TAPE BUFFER. 4*MKQ+13 WORDS INTO THETA                       S0309600
      CALL INPOUP(1,THETA,4*MKQ+13)                                     S0309610
      IF (NOGO .GT. 0) GO TO 2410                                       S0309620
      GO TO 950                                                         S0309630
  940 READ (IUNT,9006) HOUR,THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,SIGAPUS0309640
     1,SIGEPL,SIGAPL,ALPHA                                              S0309650
  950 KFLGS = KFLG                                                      S0309660
      I = HOUR                                                          S0309670
      IF (HOUR .GE. 100) I = HOUR/100                                   S0309680
C                                                                       S0309690
C$$$$                                                                   S0309700
C     THIS CODING ASSUMES A 36 BIT WORD, 6 INTEGER VALUES PER WORD,     S0309710
C     6 BITS PER VALUE.                                                 S0309720
      J = IABS(IH-1)*6                                                  S0309730
      K = MOD(J,36)                                                     S0309740
      J = J/36+1                                                        S0309750
C     STORE SIX VALUES IN ONE WORD - TAKE 6 BITS FROM I STARTING AT BIT S0309760
C     31 AND STORE INTO IHOUR(J) STARTING AT BIT K+1. THE REMAINDER OF  S0309770
C     IHOUR(J) IS UNCHANGED. BITS ARE COUNTED FROM THE LEFT (SIGN BIT)  S0309780
C     STARTING AT BIT 1.                                                S0309790
      BITS(IHOUR(J),K+1,6) = BITS(I,31,6)                               S0309800
C$$$$                                                                   S0309810
  960 K = 0                                                             S0309820
  970 K = K+1                                                           S0309830
      IF (K .GT. KFLGS) GO TO 1000                                      S0309840
      DO 980 L=1,NSOURC                                                 S0309850
      IF (NUMSQ(L) .EQ. NUMSQB(K)) GO TO 970                            S0309860
  980 CONTINUE                                                          S0309870
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      KFLGS = KFLGS-1                                                    S0309880
      IF (K .GE. KFLGS) GO TO 960                                        S0309890
      DO 990 L=K,KFLGS                                                   S0309900
      NUMSQB(L) = NUMSQB(L+1)                                            S0309910
      QB(L) = QB(L+1)                                                    S0309920
      TSB(L) = TSB(L+1)                                                  S0309930
      VOLB(L) = VOLB(L+1)                                                S0309940
  990 CONTINUE                                                           S0309950
      GO TO 960                                                          S0309960
 1000 IF (MFLG .LE. 0) GO TO 1170                                        S0309970
      DO 1160 N=1,MFLG                                                   S0309980
      TSB(1+KFLGS) = -999.0                                              S0309990
      VOLB(1+KFLGS) = -999.0                                             S0310000
      READ (IUNT,9020) NUMSQB(1+KFLGS),QB(1+KFLGS),A2,A3                 S0310010
      IF (A2 .GT. 0.0) TSB(1+KFLGS) = A2                                 S0310020
      IF (TSB(1+KFLGS) .GT. 9000.0) TSB(1+KFLGS) = TSB(1+KFLGS)-10000.0 S0310030
      IF (A3 .GT. 0.0) VOLB(1+KFLGS) = A3                                S0310040
      IF (VOLB(1+KFLGS).GT.9000.0) VOLB(1+KFLGS)= VOLB(1+KFLGS)-10000.0 S0310050
      IF (KFLGS .EQ. 0) GO TO 1020                                       S0310060
      DO 1010 K=1,KFLGS                                                  S0310070
      IF (NUMSQB(K) .EQ. NUMSQB(1+KFLGS)) GO TO 1030                     S0310080
 1010 CONTINUE                                                           S0310090
 1020 K = 0                                                              S0310100
 1030 DO 1040 L=1,NSOURC                                                 S0310110
      IF (NUMSQ(L) .EQ. NUMSQB(1+KFLGS)) GO TO 1050                      S0310120
 1040 CONTINUE                                                           S0310130
      WRITE (JUNT,9033) NUMSQB(1+KFLGS)                                  S0310140
      GO TO 2410                                                         S0310150
 1050 IF (IFTAP(L) .GE. 0) GO TO 1140                                    S0310160
      IF (JFLG(L) .EQ. 4) GO TO 1130                                     S0310170
      IF (JFLG(L) .EQ. 2) GO TO 1060                                     S0310180
      WRITE (JUNT,9034) NUMSQ(L)                                         S0310190
      GO TO 2410                                                         S0310200
 1060 IF (K .GT. 0) GO TO 1090                                           S0310210
 1070 CHGQ(L) = -1.0                                                     S0310220
 1080 KFLGS = KFLGS+1                                                    S0310230
      GO TO 1160                                                         S0310240
 1090 IF (TSB(1+KFLGS) .GT. -999.0) GO TO 1100                           S0310250
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      IF (VOLB(1+KFLGS) .GT. -999.0) GO TO 1100                         S0310260
      IF (Q(K) .LE. 0.0) GO TO 1110                                     S0310270
      CHGQ(L) = QB(1+KFLGS)/QB(K)                                       S0310280
      QB(K) = QB(1+KFLGS)                                               S0310290
      GO TO 1160                                                        S0310300
 1100 IF (TSB(1+KFLGS) .GT. -999.0) TSB(K) = TSB(1+KFLGS)               S0310310
      IF (VOLB(1+KFLGS) .GT. -999.0) VOLB(K) = VOLB(1+KFLGS)            S0310320
 1110 QB(K) = QB(1+KFLGS)                                               S0310330
 1120 CHGQ(L) = -1.0                                                    S0310340
      GO TO 1160                                                        S0310350
 1130 IF (K .GT. 0) GO TO 1090                                          S0310360
      IF (TSB(1+KFLGS) .GT. -999.0) GO TO 1070                          S0310370
      IF (VOLB(1+KFLGS) .GT. -999.0) GO TO 1070                         S0310380
      IF (Q(L) .LE. 0.0) GO TO 1070                                     S0310390
      CHGQ(L) = QB(1+KFLGS)/Q(L)                                        S0310400
      GO TO 1080                                                        S0310410
 1140 IF (IFTAP(L) .EQ. 0) GO TO 1150                                   S0310420
      WRITE (JUNT,9035) NUMSQ(L)                                        S0310430
      GO TO 2410                                                        S0310440
 1150 IF (K .EQ. 0) GO TO 1070                                          S0310450
      QB(K) = QB(1+KFLGS)                                               S0310460
      IF (TSB(1+KFLGS) .GT. -999.0) TSB(K) = TSB(1+KFLGS)               S0310470
      IF (VOLB(1+KFLGS) .GT. -999.0) VOLB(K) = VOLB(1+KFLGS)            S0310480
      GO TO 1120                                                        S0310490
 1160 CONTINUE                                                          S0310500
 1170 IF (KFLGS .EQ. 0) GO TO 1220                                      S0310510
      DO 1210 L=1,NSOURC                                                S0310520
      IF (JFLG(L) .NE. 3) GO TO 1210                                    S0310530
      DO 1180 K=1,KFLGS                                                 S0310540
      IF (NUMSQB(K) .EQ. NUMSQ(L)) GO TO 1190                           S0310550
 1180 CONTINUE                                                          S0310560
      WRITE (JUNT,9037) NUMSQ(L)                                        S0310570
      GO TO 2410                                                        S0310580
 1190 IF (TSB(K) .GT. -999.0) GO TO 1200                                S0310590
      IF (VOLB(K) .GT. -999.0) GO TO 1200                               S0310600
      IF (QB(K) .LE. 0.0) GO TO 1200                                    S0310610
      CHGQ(L) = Q(L)/QB(K)                                              S0310620
      QB(K) = Q(L)                                                      S0310630
      GO TO 1210                                                        S0310540
 1200 CHGQ(L) = -1.0                                                    S0310550
      QB(K) = Q(L)                                                      S0310560
 1210 CONTINUE                                                          S0310570
 1220 CONTINUE                                                          S0310580
      IF (KSW .LT. 2) GO TO 1230                                        S0310590
C     WRITE TAPE BUFFER, 4*MKQ+13 WORDS FROM THETA                      S0310700
      CALL INPOUP(2,THETA,4*MKQ+13)                                     S0310710
 1230 CONTINUE                                                          S0310720
      DO 1240 I=1,6                                                     S0310730
      IF (ISTBLE .EQ. IST(I)) GO TO 1250                                S0310740
 1240 CONTINUE                                                          S0310750
      I = 0                                                             S0310760
      GO TO 1280                                                        S0310770
 1250 CONTINUE                                                          S0310780
C     PROVIDE FOR DEFAULT MET VALUES                                    S0310790
      IF (P .GT. 0.0) GO TO 1280                                        S0310800
      DO 1260 J=1,5                                                     S0310810
      IF (UBAR .LE. SPDAT(J)) GO TO 1270                                S0310820
 1260 CONTINUE                                                          S0310830
      J = 6                                                             S0310840
 1270 P = PP(J,I)                                                       S0310850
 1280 CONTINUE                                                          S0310860
      IF (ISW(16) .NE. 0) GO TO 1310                                    S0310870
      IF (I .EQ. 0) GO TO 1300                                          S0310880
      IF (ISW(17) .NE. 0) GO TO 1290                                    S0310890
      IF (SIGEPU .LE. 0.0) SIGEPU = SIGEU(I)                            S0310900
      IF (SIGAPU .LE. 0.0) SIGAPU = SIGAU(I)                            S0310910
      GO TO 1300                                                        S0310920
 1290 IF (SIGEPU .LE. 0.0) SIGEPU = SIGEL(I)                            S0310930
      IF (SIGAPU .LE. 0.0) SIGAPU = SIGAL(I)                            S0310940
 1300 SIGAPL = SIGAPU                                                   S0310950
      SIGEPL = SIGEPU                                                   S0310960
 1310 IF (SIGEPU .GE. 1.0) SIGEPU = SIGEPU*RADIAN                       S0310970
      IF (SIGAPU .GE. 1.0) SIGAPU = SIGAPU*RADIAN                       S0310980
      IF (SIGEPL .GE. 1.0) SIGEPL = SIGEPL*RADIAN                       S0310990
      IF (SIGAPL .GE. 1.0) SIGAPL = SIGAPL*RADIAN                       S0311000
      IF (ALPHA .LE. 0.0) ALPHA = 0.9                                   S0311010
      IF (SIGEPU .GT. 0.0.OR.SIGEPL .GT. 0.0) GO TO 1320
      WRITE (JUNT,9039)                                                 S0311020
      GO TO 2410                                                        S0311030
 1320 IF (SIGAPU .GT. 0.0.OR.SIGAPL .GT. 0.0) GO TO 1330                S0311040
      WRITE (JUNT,9040)                                                 S0311050
      GO TO 2410                                                        S0311060
 1330 CONTINUE                                                          S0311070
      IF (UBAR .GT. 0.0) GO TO 1340                                     S0311080
      LINE = LINE+2                                                     S0311090
      WRITE (JUNT,9028)                                                 S0311100
      GO TO 2410                                                        S0311110
 1340 IF (HM .GT. 0.0) GO TO 1350                                       S0311120
      WRITE (JUNT,9029)                                                 S0311130
      GO TO 2410                                                        S0311140
 1350 IF (TA .GT. 0.0) GO TO 1360                                       S0311150
      WRITE (JUNT,9030)                                                 S0311160
      GO TO 2410                                                        S0311170
 1360 IF (P .GT. 0.0) GO TO 1370                                        S0311180
      WRITE (JUNT,9031)                                                 S0311190
      LINE = LINE+2                                                     S0311200
 1370 CONTINUE                                                          S0311210
      IF (ISW(8) .EQ. 0) GO TO 1420                                     S0311220
      CALL TITLR(ITC,1,3)                                               S0311230
      ITC = 1                                                           S0311240
      IF (IPC .EQ. 0) GO TO 1380                                        S0311250
      WRITE(JUNT,9017)                                                  S0311260
      LINE = 5+LINE                                                     S0311270
 1380 WRITE (JUNT,9018) HOUR,THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,     S0311280
     1 SIGAPU,SIGEPL,SIGAPL,ALPHA                                       S0311290
      IF (KFLGS .EQ. 0) GO TO 1410                                      S0311300
C     PRINT VARIABLE SOURCE INFO                                        S0311310
      DO 1400 L=1,KFLGS                                                 S0311320
      CALL TITLR(ITC,1,3)                                               S0311330
      IF (IPC .EQ. 0) GO TO 1390                                        S0311340
      WRITE(JUNT,9017)                                                  S0311350
      LINE = LINE+5                                                     S0311360
 1390 WRITE (JUNT,9025) NUMSOB(L),QB(L),TSB(L),VOLB(L)                  S0311370
 1400 CONTINUE                                                          S0311380
                                                                        S0311390
 1410 CONTINUE                                                                          S0311400
C     CALCULATE PARAMETERS THAT VARY WITH HOUR ONLY                                     S0311410
 1420 THETA = (THETA-ROTATE)*RADIAN                                                     S0311420
      PHS = SIN(THETA)                                                                  S0311430
      PHC = COS(THETA)                                                                  S0311440
      IF (DPDZ .LE. 0.0) GO TO 1430                                                     S0311450
      S = G*DPDZ/TA                                                                     S0311460
      SQ = SQRT(S)                                                                      S0311470
      SQI = 1.0/SQ                                                                      S0311480
      E4 = 3.1415926*SQI                                                                S0311490
 1430 IF (ALPHA-1.0) 1440,1450,1440                                                     S0311500
 1440 A2 = XRY*ALPHA                                                                    S0311510
      A3 = XRY*(1.0-ALPHA)                                                              S0311520
      ALPHAI = 1.0/ALPHA                                                                S0311530
      A5 = XRY*A2**(-ALPHA)                                                             S0311540
 1450 D2 = D1/SIGAPU                                                                    S0311550
C                                                                                       S0311560
C-************************************************************************************S0311570
C     START MAIN LOOP OVER SOURCES                                                      S0311580
      LG = 0                                                                            S0311590
      DO 2190 L=1,NSOURC                                                                S0311600
      NSS = NS(L)                                                                       S0311610
      CALL ZRO(CON(1,5),NXXYY)                                                          S0311620
      IF (KSW .NE. 1.AND.KSW .NE. 3) GO TO 1480                                         S0311630
      IF (IFTAP(L) .EQ. 0) GO TO 1490                                                   S0311640
 1460 LG = LG+1                                                                         S0311650
C     READ CONCENTRATION FROM TAPE BUFFER, NXXYY WORDS INTO CON(1,5)                    S0311660
      CALL INPOUP(1,CON(1,5),NXXYY)                                                     S0311670
      IF (NOSS .GT. 0) GO TO 2410                                                       S0311680
      IF (IABS(IFTAP(L)) .GT. LG) GO TO 1460                                            S0311690
      IF (IFTAP(L) .GT. 0) GO TO 2160                                                   S0311700
      IF (CHGQ(L) .LT. 0.0) GO TO 1480                                                  S0311710
C     RESCALE                                                                           S0311720
      DO 1470 I=1,NXXYY                                                                 S0311730
 1470 CON(I,5) = CON(I,5)*CHGQ(L)                                                       S0311740
      GO TO 2160                                                                        S0311750
 1480 CONTINUE                                                                          S0311760
      IF (JFLG(L) .EQ. 0) GO TO 1510                                                    S0311770
      DO 1490 I=1,KFLGS                                               S0311780
      IF (NUMSO(L) .EQ. NUMSOB(I)) GO TO 1500                         S0311790
 1490 CONTINUE                                                        S0311800
      WRITE (JUNT,9036) NUMSO(L)                                      S0311810
      GO TO 2410                                                      S0311820
 1500 QP = QB(I)                                                      S0311830
      IF (TYPE(L) .GT. 0) GO TO 1520                                  S0311840
      TSP = TS(L)                                                     S0311850
      VOLP = VOL(L)                                                   S0311860
      IF (TSB(I) .GT. -999.)) TSP = TSB(I)                            S0311870
      IF (VOLB(I) .GT. -999.)) VOLP = VOLB(I)*A1                      S0311880
      WP = 0.0                                                        S0311890
      IF (RDS(L) .LE. 0.0) GO TO 1520                                 S0311900
      WP = VOLP/(3.1415926*RDS(L)*RDS(L))*A1                          S0311910
      GO TO 1520                                                      S0311920
 1510 QP = Q(L)                                                       S0311930
      IF (TYPE(L) .GT. 0) GO TO 1520                                  S0311940
      TSP = TS(L)                                                     S0311950
      VOLP = VOL(L)                                                   S0311960
      WP = W(L)                                                       S0311970
 1520 CONTINUE                                                        S0311980
      IF (QP .GT. 0.0) GO TO 1530                                     S0311990
      CALL ZRO(CON(1,5),NKXYY)                                        S0312000
      GO TO 2160                                                      S0312010
 1530 CONTINUE                                                        S0312020
      HP = H(L)                                                       S0312030
      DELH = H(L)                                                     S0312040
      HAHS = HA-HS(L)                                                 S0312050
C     CHECK SOURCE TYPE                                               S0312060
      IF (TYPE(L) .GT. 0) GO TO 1660                                  S0312070
C     PLUME RISE FOR ELEVATED SOURCES                                 S0312080
      T = TSP                                                         S0312090
      IF (T .LE. 0.0) T = ABS(T)+TA                                   S0312100
      IF (T .GE. TA) GO TO 1540                                       S0312110
      T = TA                                                          S0312120
      WRITE (JUNT,9021) NUMSO(L)                                      S0312130
      LINE = LINE+1                                                   S0312140
 1540 CONTINUE                                                        S0312150
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      IF (ISW(9) .EQ. 0) GO TO 1550                                         S0312160
      V1 = H(L)                                                             S0312170
      GO TO 1560                                                            S0312180
 1550 V1 = ZR                                                               S0312190
      IF (H(L)+HS(L) .GT. HA+ZR) V1 = H(L)+HS(L)-HA                         S0312200
 1560 V1 = V1+ZRI                                                           S0312210
      UBH = UBAR*V1**P                                                      S0312220
      FCT = 1.0                                                             S0312230
      IF (VP  LE. 0.0) GO TO 1580                                           S0312240
      IF (VP  GE. 1.5*UBH) GO TO 1580                                       S0312250
      IF (VP  LE. UBH) GO TO 1570                                           S0312260
      FCT = 3.0*(1.0-UBH/VP)                                                S0312270
      GO TO 1580                                                            S0312280
 1570 FCT = 0.0                                                             S0312290
 1580 CONTINUE                                                              S0312300
      F = VOLP*(1.0-TA/T)                                                   S0312310
      IF (DPDZ     .GT. 0) GO TO 1600                                       S0312320
C     UNSTABLE ATMOSPHERE                                                   S0312330
      DELH = ((    F*H10SQ(L))**.33333333)/UBH                              S0312340
 1590 XR = H10(L)                                                           S0312350
      GO TO 1620                                                            S0312360
 1600 E2 = C1*F/(UBH*S)                                                     S0312370
      E3 = UBH*E4                                                           S0312380
C     STABLE ATMOSPHERE                                                     S0312390
      IF (E3 .LT. H10(L)) GO TO 1610                                        S0312400
      DELH = (E2*(1.0-COS(H10(L)*SQ/UBH)))**.33333333                       S0312410
      GO TO 1590                                                            S0312420
 1610 DELH = (2.0*E2)**.33333333                                            S0312430
      XR = E3                                                               S0312440
 1620 CONTINUE                                                              S0312450
      DELH = DELH*FCT                                                       S0312460
      HP = H(L)+DELH                                                        S0312470
C     IS PLUME RISE GREATER THAN MIXING DEPTH                               S0312480
      IF (HP .GT. HM+HAHS) GO TO 2160                                       S0312490
      XS = DX(L)                                                            S0312500
      YS = DY(L)                                                            S0312510
      SIGE = SIGEPU                                                         S0312520
      SIGA = SIGAPU                                                         S0312530
      IF (SIGE .GT. 0.0.AND.SIGA .GT. 0.0) GO TO 1630                   S0312340
      WRITE (IUNT,9026)                                                 S0312350
      GO TO 2410                                                        S0312360
 1630 CONTINUE                                                          S0312370
      E3 = D1                                                           S0312380
      IF (ISW(9) .EQ. 0) GO TO 1640                                     S0312390
      V1 = HP                                                           S0312500
      GO TO 1650                                                        S0312510
 1640 V1 = ZR                                                           S0312520
      IF (HP+HS(L) .GT. HA+ZR) V1 = HP+HS(L)-HA                         S0312530
 1650 V1 = V1+ZR1                                                       S0312540
      UBH = 1.0/(UBAR*Z1**P)                                            S0312550
      XY = D2+DELH                                                      S0312560
      GO TO 1720                                                        S0312570
 1660 CONTINUE                                                          S0312580
C     LOW LEVEL SOURCES                                                 S0312590
C     IF BUILDING SOURCE AND HEIGHT GREATER THAN MIXING DEPTH           S0312700
      IF (TYPE(L) .EQ. 1.AND. H(L) .GT. HM+HAHS) GO TO 2160             S0312710
      IF (HP .LT. 5.0) HP = 5.0                                         S0312720
      E2 = ABS(DTH(L)-THETA)                                            S0312730
      PHS1 = ABS(SIN(E2))                                               S0312740
      PHC1 = ABS(COS(E2))                                               S0312750
      XO = S1(L)*PHS1+S2(L)*PHC1                                        S0312760
      YO = S1(L)*PHC1+S2(L)*PHS1                                        S0312770
      IF (XO .GT. YO) GO TO 1670                                        S0312780
      YO = S2(L)                                                        S0312790
      XO = S1(L)                                                        S0312300
      GO TO 1680                                                        S0312310
 1670 XO = S2(L)                                                        S0312320
      YO = S1(L)                                                        S0312330
 1680 CONTINUE                                                          S0312340
C     XO,YO ARE THE SOURCE DIMENSIONS                                   S0312350
      YS = .5*XO                                                        S0312360
      XS = YS*PHS+DX(L)                                                 S0312370
      YS = YS*PHC+DY(L)                                                 S0312380
C     XS,YS IS THE START POINT OF THE CLOUD AXIS                        S0312390
      XR = XO                                                           S0312900
      SIGE = SIGEPL                                                     S0312910
      SIGA = SIGAPL                                                     S0312920
      IF (SIGE .GT. 0.).AND.SIGA .GT. 0.0) GO TO 1690                   S0312930
      WRITE (JUNT,9027)                                                 S0312940
      GO TO 2410                                                        S0312950
 1690 CONTINUE                                                          S0312960
      V1 = HP                                                           S0312970
      IF (V1 .LT. 5.0) V1 = 5.0                                         S0312980
      IF (ISW(9) .NE. 0) GO TO 1710                                     S0312990
      IF (V1+HS(L) .GT. HA+ZR) GO TO 1700                               S0313000
      V1 = ZR                                                           S0313010
      GO TO 1710                                                        S0313020
 1700 V1 = V1+HS(L)-HA                                                  S0313030
 1710 V1 = V1+ZR1                                                       S0313040
      UBH = 1.0/(UBAR*V1**P)                                            S0313050
      IF (TYPE(L) .EQ. 2) GO TO 1770                                    S0313060
C     BUILDING EMISSIONS                                                S0313070
      E3 = E1                                                           S0313080
      XY = Y0+.232558139/SIGA                                           S0313090
 1720 CONTINUE                                                          S0313100
      PP2 = PP1+DP*UBH                                                  S0313110
      P12 = P1                                                          S0313120
C     CALCULATE PART OF SIGY AND SIGZ                                   S0313130
      XZ = E3+DELH-XR*SIGE                                              S0313140
      IF (XZ .LT. 0.0) XZ = 0.0                                         S0313150
C     SIGZ = SIGE*XP+XZ                                                 S0313160
      IF (ALPHA-1.0) 1730,1760,1730                                     S0313170
 1730 IF (XY .GT. XRY) GO TO 1740                                       S0313180
      XY = XY-XR                                                        S0313190
      GO TO 1750                                                        S0313200
 1740 XY = A2*(XY*A4)**ALPHAI-XR+A3                                     S0313210
 1750 IF (XY .LT. 0.0) XY = 0.0                                         S0313220
      XY = XY-A3                                                        S0313230
      B4 = A5*SIGA                                                      S0313240
C     SIGY = B4*(XP+XY)**ALPHA                                          S0313250
      GO TO 1780                                                        S0313260
 1760 XY = (XY-XR)*SIGA                                                 S0313270
      IF (XY .LT. 0.0) XY = 0.0                                         S0313280
C     SIGY = SIGA*XP+XY                                                 S0313290
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      GO TO 1780                                                        S0313300
 1770 CONTINUE                                                          S0313310
C     AREA SOURCES                                                      S0313320
      E3 = .5*X0                                                        S0313330
      XZ = E3*SIGE+H(L)                                                 S0313340
C     SIGZ = SIGE*XP+XZ                                                 S0313350
      XY = E3*SIGA                                                      S0313360
      E3 = SIGE*Y0                                                      S0313370
      T = .5*Y0                                                         S0313380
      P12 = P1                                                          S0313390
      PP2 = PS1+QP*UBH/Y0                                               S0313400
      EF = 1.0/(SIGE*X0)                                                S0313410
      XR = PP2+2.0*EF                                                   S0313420
      B4 = SIGE/(SIGE+H(L))                                             S0313430
C     POINTS INSIDE AREA PP3 = XR*ALOG(B4*XP+1.0)                       S0313440
      E2 = 3.0*X0                                                       S0313450
 1780 CONTINUE                                                          S0313460
      IF (DECAY .LE. 0.0) GO TO 1790                                    S0313470
      F = -DECAY*UBH                                                    S0313480
 1790 IF (NS(L) .LE. 0) GO TO 1810                                      S0313490
      NSS = NS(L)                                                       S0313500
      DO 1800 N=1,NSS                                                   S0313510
 1800 VSQ(N) = VS(N,L)*UBH                                              S0313520
 1810 CONTINUE                                                          S0313530
C                                                                       S0313540
C                                                                       S0313550
C-**********************************************************************S0313560
C     START MAIN LOOP OVER Y COORDINATES                                S0313570
      IF (NYPNTS .LE. 0) GO TO 1970                                     S0313580
      IKSW = 1                                                          S0313590
      J = 0                                                             S0313600
 1920 J = J+1                                                           S0313610
      IF (J .GT. NYPNTS) GO TO 1970                                     S0313620
      JJJ = (J-1)*NXPNTS                                                S0313630
      IF (ISW(13) .NE. 0) GO TO 1830                                    S0313640
      YY = Y(J)-YS                                                      S0313650
      Y11 = YY*PHC                                                      S0313660
      Y12 = YY*PHS                                                      S0313670
      GO TO 1840                                                        S0313580
 1830 CN1 = Y(J)+RADIAN                                                 S0313590
      SN1 = SIN(CN1)                                                    S0313700
      CN1 = COS(CN1)                                                    S0313710
 1840 CONTINUE                                                          S0313720
C                                                                       S0313730
C-+*********************************************************************S0313740
C     START MAIN LOOP OVER X COORDINATES                                S0313750
      I = 0                                                             S0313760
 1850 I = I+1                                                           S0313770
      IF (I .GT. NXPNTS) GO TO 1920                                     S0313780
      IJ = JJJ+I                                                        S0313790
      IF (ISW(13) .NE. 0) GO TO 1860                                    S0313800
      XX = X(I)-XS                                                      S0313810
      GO TO 1910                                                        S0313820
 1860 YY = X(I)*CN1+UTMY-YS                                             S0313830
      XX = X(I)*SN1+UTMX-XS                                             S0313840
      Y11 = YY*PHC                                                      S0313850
      Y12 = YY*PHS                                                      S0313860
      GO TO 1910                                                        S0313870
 1870 IKSW = 2                                                          S0313880
C     LOOP OVER DISCRETE RECEPTORS                                      S0313890
      IF (NXWYPT .LE. 0) GO TO 2160                                     S0313900
      IJ = NXYPTS                                                       S0313910
 1880 IJ = IJ+1                                                         S0313920
      IF (IJ .GT. NXXYY) GO TO 2160                                     S0313930
      I = NIJ+IJ-NXYPTS                                                 S0313940
      J = NJI+IJ-NXYPTS                                                 S0313950
      IF (ISW(14) .NE. 0) GO TO 1890                                    S0313960
      XX = X(I)-XS                                                      S0313970
      YY = Y(J)-YS                                                      S0313980
      GO TO 1900                                                        S0313990
 1890 CN1 = Y(J)+RADIAN                                                 S0314000
      XX = X(I)*SIN(CN1)-XS                                             S0314010
      YY = X(I)*COS(CN1)-YS                                             S0314020
 1900 CONTINUE                                                          S0314030
      Y11 = YY*PHC                                                      S0314040
      Y12 = YY*PHS                                                      S0314050
 1910 ZF = ZZ(IJ)                                                       S0314060
      IF (ISN(7) .EQ. 0.OR.NSS .GT. 0) ZF = 0.0                         S0314070
      NFLG = 0                                                          S0314080
C     CALCULATE COORDINATES OF X,Y RELATIVE TO XS,YS                    S0314090
      XP = -XX*PHS-Y11                                                  S0314100
      YP =  XX*PHC-Y12                                                  S0314110
C     IS DISTANCE DOWNWIND NEGATIVE                                     S0314120
      IF (XP .LE. 0.0) GO TO 2150                                       S0314130
      IF (TYPE(L) .EQ. 0) GO TO 1930                                    S0314140
      IF (TYPE(L) .EQ. 1) GO TO 1920                                    S0314150
      IF (XP .GT. X0) GO TO 1970                                        S0314160
      IF (ABS(YP) .GT. T) GO TO 2150                                    S0314170
C     POINT WITHIN AREA SOURCE CALCULATE CONCENTRATION                  S0314180
      W2 = ALOG(B4*XP+1.0)                                              S0314190
      PP3 = XR*W2                                                       S0314200
      SIGZS = W2*EF                                                     S0314210
      IF (SIGZS .LE. 0.0) GO TO 2150                                    S0314220
      SIGZ = 1.0/SIGZS                                                  S0314230
      NFLG = 1                                                          S0314240
      GO TO 2040                                                        S0314250
 1920 CONTINUE                                                          S0314260
C     BUILDING                                                          S0314270
      IF (XP .LE. X0) GO TO 2150                                        S0314280
 1930 SIGZ = SIGE*XP+XZ                                                 S0314290
      IF (SIGZ .LE. 0.0) GO TO 2150                                     S0314300
      IF (ALPHA-1.0) 1940,1950,1940                                     S0314310
 1940 SIGY = XP+XY                                                      S0314320
      IF (SIGY .LE. 0.0) GO TO 2150                                     S0314330
      SIGY = B4*SIGY**ALPHA                                             S0314340
      GO TO 1960                                                        S0314350
 1950 SIGY = SIGA*XP+XY                                                 S0314360
 1960 IF(SIGY .LE. 0.0) GO TO 2150                                      S0314370
      SIGZS = 1.0/SIGZ                                                  S0314380
      SIGYS = 1.0/SIGY                                                  S0314390
      PP3 = PP2*SIGYS+SIGZS                                             S0314400
      GO TO 2000                                                        S0314410
 1970 CONTINUE                                                          S0314420
C     AREA SOURCE                                                       S0314430
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      XP = XP-X0                                                        S0314440
      IF (XP .GT. E2) GO TO 1980                                        S0314450
      SIGZ = E3/ALOG((SIGE*(XP+X0)+H(L))/(SIGE*XP+H(L)))                S0314460
      GO TO 1990                                                        S0314470
 1980 SIGZ = SIGE*XP+XZ                                                 S0314480
 1990 IF (SIGZ .LE. 0.0) GO TO 2150                                     S0314490
      SIGY = SIGA*XP+XY                                                 S0314500
      IF (SIGY .LE. 0.0) GO TO 2150                                     S0314510
      SIGYS = 1.0/SIGY                                                  S0314520
      SIGZS = 1.0/SIGZ                                                  S0314530
      PP3 = PP2*SIGZS                                                   S0314540
 2000 CONTINUE                                                          S0314550
C     CALCULATE DECAY                                                   S0314560
      IF (DECAY .LE. 0.0) GO TO 2010                                    S0314570
      IF (TYPE(L) .EQ. 1) XP = XP-X0                                    S0314580
      PP3 = PP3*EXP(F*XP)                                               S0314590
 2010 CONTINUE                                                          S0314600
C     CALCULATE LATERAL TERM                                            S0314610
      IF (NFLG .EQ. 1) GO TO 2040                                       S0314620
      IF (TYPE(L) .EQ. 2) GO TO 2020                                    S0314630
      W2 = YP*SIGYS                                                     S0314640
      W2 = -.5*W2*W2                                                    S0314650
      IF (W2 .LT. -30.0) GO TO 2150                                     S0314660
      W3 = EXP(W2)                                                      S0314670
      GO TO 2030                                                        S0314680
 2020 W2 = P2*SIGYS                                                     S0314690
      W3 = (T+YP)*W2                                                    S0314700
      W2 = (T-YP)*W2                                                    S0314710
      CALL ERFX                                                         S0314720
 2030 CONTINUE                                                          S0314730
      PP3 = PP3*W3                                                      S0314740
 2040 CONTINUE                                                          S0314750
      HMP = HM                                                          S0314760
      IF (ZF .LT. HA) HMP = HMP+(HA-ZF)                                 S0314770
      IF (ZF .LE. HM+HA) GO TO 2050                                     S0314780
      IMSG = IMSG+1                                                     S0314790
      IF (IMSG .GT. 50) GO TO 2150                                      S0314800
      LINE = LINE+1                                                     S0314810
      WRITE (JUNT,9023) NUMSO(L),HOUR,X(I),Y(J)
      IF (IMSG .NE. 50) GO TO 2150                                      S0314920
      WRITE (JUNT,9024)                                                 S0314930
      GO TO 2150                                                        S0314940
 2050 CONTINUE                                                          S0314950
      SIGZI = -.5*SIGZS*SIGZS                                           S0314960
C     CALCULATE VERTICAL TERM                                           S0314970
      IF (NSS .GT. 0) GO TO 2110                                        S0314980
C     NON - PARTICULATE                                                 S0314990
      V = 1.0                                                           S0314900
      HPL = 0.0                                                         S0314910
      IF (TYPE(L) .GT. 1) GO TO 2070                                    S0314920
      HPL = HP+HS(L)-ZF                                                 S0314930
      IF (HPL .GT. 0.0) GO TO 2060                                      S0314940
      HPL = 0.0                                                         S0314950
      GO TO 2070                                                        S0314960
 2060 Z = HPL*HPL*SIGZI                                                 S0314970
      IF (Z .LT. -30.0) GO TO 2150                                      S0314980
      V = EXP(Z)                                                        S0314990
 2070 Z = 0.0                                                           S0315000
 2080 Z = Z+2.0                                                         S0315010
      IF (Z .GT. 6.0) GO TO 2100                                        S0315020
      VLM = Z*HMP                                                       S0315030
      W2 = VLM-HPL                                                      S0315040
      W2 = W2*W2*SIGZI                                                  S0315050
      IF (W2 .LT. -10.0) GO TO 2130                                     S0315060
      IF (TYPE(L) .GT. 1) GO TO 2090                                    S0315070
      W3 = VLM+HPL                                                      S0315080
      V = V+EXP(W2)+EXP(W3*W3*SIGZI)                                    S0315090
      GO TO 2080                                                        S0315100
 2090 V = V+2.0*EXP(W2)                                                 S0315110
      GO TO 2080                                                        S0315120
 2100 V = P12*SIGZ/HMP                                                  S0315130
      GO TO 2130                                                        S0315140
 2110 CONTINUE                                                          S0315150
C     PARTICULATE VERTICAL TERM                                         S0315160
      V = 0.0                                                           S0315170
      HPL = HP                                                          S0315180
                                                                        S0315190
      IF (TYPE(L) .EQ. 2) HPL = 0.0                                     S0315200
      Z5 = 2.0*HMP-HPL                                                  S0315210
      DO 2120 N=1,NSS                                                   S0315220
      W2 = VSQ(N)*XP                                                    S0315230
      W3 = Z5+W2                                                        S0315240
      W2 = HPL-W2                                                       S0315250
      W2 = W2*W2*SIGZI                                                  S0315260
      W3 = W3*W3*SIGZI                                                  S0315270
      V1 = 0.0                                                          S0315280
      V2 = 0.0                                                          S0315290
      IF (W2 .GT. -30.0) V1 = EXP(W2)                                   S0315300
      IF (W3 .GT. -30.0) V2 = EXP(W3)                                   S0315310
      V = V+FREQ(N,L)*(V1+V2)                                           S0315320
 2120 CONTINUE                                                          S0315330
 2130 PP3 = PP3*V                                                       S0315340
 2140 CONTINUE                                                          S0315350
      CON(IJ,5) =PP3                                                    S0315360
C                                                                       S0315370
C     END OF X COORDINATE AND Y COORDINATE LOOP                         S0315380
 2150 CONTINUE                                                          S0315390
      GO TO (1850,1880),IKSW                                            S0315400
 2160 CONTINUE                                                          S0315410
      IF (KSW .LE. 1) GO TO 2170                                        S0315420
C     WRITE CONCENTRATION TO TAPE BUFFER, NXXYY WORDS FROM CON(1,5)     S0315430
      CALL INPOUP(2,CON(1,5),NXXYY)                                     S0315440
      IF (NOGO .GT. 0) GO TO 2410                                       S0315450
 2170 CONTINUE                                                          S0315460
C     SAVE CONCENTRATION FOR SPECIAL REPORTS                            S0315470
      JOREC = JOREC+1                                                   S0315480
      IOREC = JOREC                                                     S0315490
      IF (ISW(11) .EQ. 0.OR.ND .EQ. 1) GO TO 2180                       S0315500
C     READ MASS STORAGE LU 12, RECORD IOREC                             S0315510
      READ (12'IOREC) (CON(I,1),I=1,NXXYY)                              S0315520
      CALL ACCM(CON(1,3),CON(1,1),NXXYY)                                S0315530
      IOREC = JOREC                                                     S0315540
 2180 CONTINUE                                                          S0315550
C     WRITE MASS STORAGE LU 12, RECORD IOREC                            S0315560
      WRITE (12'IOREC) (CON(I,5),I=1,NXXYY)                             S0315570
      IF (ISW(11) .NE. 0.AND.ND .GT. 1) GO TO 2190                      S0315380
      NREC = JOREC                                                      S0315390
      IF (IH .GT. 1) GO TO 2190                                         S0315500
C     SAVE RECORD NUMBER VS. SOURCE ID                                  S0315510
      IARRY(L) = JOREC                                                  S0315520
C                                                                       S0315530
C     END MAIN LOOP OVER SOURCES                                        S0315540
 2190 CONTINUE                                                          S0315550
C                                                                       S0315560
C     END MAIN LOOP OVER HOURS                                          S0315570
 2200 CONTINUE                                                          S0315580
      IF (ISW(11) .NE. 0.AND.ND .LT. NDAYS) GO TO 2390                  S0315590
C     CHECK FOR SPECIAL OUTPUT OF INDIVIDUAL GROUPS OF SOURCES          S0315700
      L = 0                                                             S0315710
 2210 L = L+1                                                           S0315720
      IF (L .GT. NGROUP) GO TO 2390                                     S0315730
      I3 = 0                                                            S0315740
      IPL = -NSOURC                                                     S0315750
      NSS = 0                                                           S0315760
      NR = NSOGRP(L)                                                    S0315770
      M = 0                                                             S0315780
      IF (L .EQ. 1) GO TO 2230                                          S0315790
      K = L-1                                                           S0315800
      DO 2220 I=1,K                                                     S0315810
 2220 M = M+NSOGRP(I)                                                   S0315820
 2230 CONTINUE                                                          S0315830
      N = 0                                                             S0315840
      IB = 0                                                            S0315850
 2240 N = N+1                                                           S0315860
      IF (N .GT. NR) GO TO 2330                                         S0315870
      M = M+1                                                           S0315880
      NM = IMSOR(M)                                                     S0315890
      IFLG = 0                                                          S0315900
      IB = IB+2                                                         S0315910
      IF (IB .GT. 100) IB = 100                                         S0315920
      IPRT(IB) = IDSOR(M)                                               S0315930
      IPRT(IB-1) = IBLNK                                                S0315940
      IF (NM .GT. 0 AND) IB .GT. 2) IPRT(IB-1) = ICOM                   S0315950
      IF (NM .GT. 0) GO TO 2300                                        S0315960
      IF (NM .LT. 0) GO TO 2260                                        S0315970
 2250 IB = IB-2                                                        S0315980
      GO TO 2240                                                       S0315990
 2260 IF (N .GT. 1) GO TO 2270                                         S0316000
      NM = 0                                                           S0316010
      IPRT(IB+2) = IPRT(IB)                                            S0316020
      IPRT(IB+1) = IPRT(IB-1)                                          S0316030
      IPRT(IB) = NUMSQ(1)                                              S0316040
      IPRT(IB-1) = IBLNK                                               S0316050
      IB = IB+2                                                        S0316060
      GO TO 2280                                                       S0316070
 2270 NM = IMSOR(M-1)                                                  S0316080
 2280 II = IABS(IMSOR(M))                                              S0316090
      IFLG = 1                                                         S0316100
 2290 NM = NM+1                                                        S0316110
      IF (NM .GT. II) GO TO 2240                                       S0316120
 2300 JJ = IARRY(NM)                                                   S0316130
      IF (JJ .GT. 0.AND.JJ .LE. NREC) GO TO 2310                       S0316140
      GO TO 2320                                                       S0316150
 2310 NSS = NSS+1                                                      S0316160
      NUMSQB(NSS) = JJ                                                 S0316170
 2320 IF (IFLG .EQ. 1) GO TO 2290                                      S0316180
      GO TO 2240                                                       S0316190
 2330 CONTINUE                                                         S0316200
      IF (NSS .LE. 0) GO TO 2210                                       S0316210
      DO 2370 IH=1,NHOURS                                              S0316220
      I3 = I3+ISW(1)                                                   S0316230
      IPL = IPL+NSOURC                                                 S0316240
      CALL ZRO(CON,NXXYY)                                              S0316250
      DO 2340 J=1,NSS                                                  S0316260
      IOREC = NUMSQB(J)+IPL                                            S0316270
      IF (IOREC .GT. NREC) GO TO 2340                                  S0316280
C     READ MASS STORAGE LU 12, RECORD IOREC                            S0316290
      READ (12'IOREC) (CON(I,5),I=1,NXXYY)                             S0316300
      CALL ACCM(CON,CON(1,5),NXXYY)                                    S0316310
 2340 CONTINUE                                                         S0316320
      DO 2360 IP=2,5                                                   S0316330
      IF (ISW(IP) .LE. 0) GO TO 2360                                    S0316340
      IF (IP .EQ. 2) GO TO 2350                                         S0316350
      CALL ACCM(CON(1,IP-1),CON,NXXYY)                                  S0316360
      IF (MOD(I3,ISW(IP)) .NE. 0) GO TO 2360                            S0316370
      CALL ACM(CON(1,IP-1),DD1(IP-2),NXXYY)                             S0316380
 2350 CALL OUTPT(MSRS,IP-1,X,Y,CON(1,IP-1))                             S0316390
      IF (IP .EQ. 2) GO TO 2360                                         S0316400
      CALL ZRO(CON(1,IP-1),NXXYY)                                       S0316410
 2360 CONTINUE                                                          S0316420
 2370 CONTINUE                                                          S0316430
      GO TO 2210                                                        S0316440
 2380 CONTINUE                                                          S0316450
C                                                                       S0316460
C     END MAIN LOOP OVER DAYS                                           S0316470
 2390 CONTINUE                                                          S0316480
      IF (KSW .NE. 2.AND.KSW .NE. 3) GO TO 2400                         S0316490
C     CLOSE OUTPUT TAPE FILE                                            S0316500
      CALL INPOUP(3,DMY1,IDMY2)                                         S0316510
 2400 CONTINUE                                                          S0316520
      IF (JUNT .EQ. 6 .OR. JUNT .EQ. 56) GO TO 2410                     S0316530
      ENDFILE JUNT                                                      S0316540
      ENDFILE JUNT                                                      S0316550
      REWIND JUNT                                                       S0316560
 2410 CONTINUE                                                          S0316570
      RETURN                                                            S0316580
C-**********************************************************************S0316590
 9001 FORMAT (8F10.0)                                                   S0316600
 9002 FORMAT (13I6)                                                     S0316610
 9003 FORMAT (20I4)                                                     S0316620
 9004 FORMAT (F7.0,F10.0,5F7.0,2F5.0,F11.0,F7.0)                        S0316630
 9005 FORMAT (20A4)                                                     S0316640
 9006 FORMAT (I4,F7.0,F8.0,F9.0,F7.0,F5.0,A1,F4.0,4F8.0,F3.0)           S0316650
 9007 FORMAT (10X,23HNUMBER OF INPUT SOURCES,32X,10H(NSOURC) =,I5/      S0316660
     110X,28HNUMBER OF X GRID COORDINATES,27X,10H(NXPNTS) =,I5/         S0316670
     210X,28HNUMBER OF Y GRID COORDINATES,27X,10H(NYPNTS) =,I5/         S0316680
     210X,33HTOTAL NUMBER OF HOURS IN EACH DAY,22X,10H(NHOURS) =,I5/    S0316690
     310X,23HNUMBER OF DAYS OR CASES,32X,10H( NDAYS) =,I5/              S0316700
     410X,65HNUMBER OF CONCENTRATION REPORTS (SOURCE COMBINATIONS)  (NGRS0316710
     5OUP) =,I5/10X,37HNUMBER OF DISCRETE CALCULATION POINTS,18X,10H(NXWS0316720
     6YPT) =,I5)                                                          S0316730
9008 FORMAT (10X,50HMET DATA INPUT CARD RATE (1=HOURLY,2=2 HOURLY,ETC),S0316740
     15X,10H(ISW(1)) =,I5/10X,48HIS CONCENTRATION CALCULATED AT BASE RATS0316750
     2E PRINTED,7X,10H(ISW(2)) =,I5/10X,51HNO. OF HOURS IN FIRST AVERAGES0316760
     3 CONCENTRATION PRINTED,4X,10H(ISW(3)) =,I5/10X,52HNO. OF HOURS IN S0316770
     4SECOND AVERAGE CONCENTRATION PRINTED,3X,10H(ISW(4)) =,I5/10X,51HNOS0316780
     5. OF HOURS IN THIRD AVERAGE CONCENTRATION PRINTED,4X,10H(ISW(5)) =S0316790
     6,I5/10X,34HARE TERRAIN ELEVATION HEIGHTS USED,21X,10H(ISW(7)) =,I5S0316800
     7/10X,31HIS WIND SPEED TERRAIN FOLLOWING,24X,10H(ISW(9)) =,I5/10X,4S0316810
     86HARE CONCENTRATIONS AVERAGED OVER DAYS OR CASES,9X,10H(ISW(11))=,S0316820
     9I5)                                                                 S0316830
9009 FORMAT (10X,29HMODEL UNITS CONVERSION FACTOR,25X,10H(   TK   ) =,E14S0316840
     1.8/                               10X,23HACCELERATION OF GRAVITY,32S0316850
     2X,10H(   G    ) =,F9.4,6X,15H(METERS/SEC**2)/10X,40HHEIGHT OF MEASURS0316860
     3EMENT OF WIND SPEED, ETC,15X,10H(   ZR   ) =,F9.4,6X,8H(METERS)/10X,S0316870
     447HENTRAINMENT COEFFICIENT FOR UNSTABLE ATMOSPHERE,3X,10H(GAMMA1) S0316880
     5=,F6.3/10X,45HENTRAINMENT COEFFICIENT FOR STABLE ATMOSPHERE,10X,10S0316890
     6H(GAMMA2) =,F6.3/10X,65HDISTANCE OVER WHICH RECTILINEAR PLUME EXPAS0316900
     7NSION OCCURS ( XRY   ) =,F8.4,7X,8H(METERS)/10X,65HDECAY COEFFICIENS0316910
     8T FOR PHYSICAL OR CHEMICAL DEPLETION  (DECAY ) =,E14.8/10X,44HANGUS0316920
     9LAR DISPL OF GRID SYSTEM FROM TRUE NORTH,11X,10H(ROTATE) =,F8.3)  S0316930
9010 FORMAT (1H0,19X,41H*-* COORDINATE SYSTEM X AXIS (METERS) *-*//(8(1S0316940
     1X,E14.8,1H,)))                                                      S0316950
9011 FORMAT (1H0,19X,30H*-* COORDINATE SYSTEM Y AXIS (,A4,A3,4H)*-*//(8S0316960
     1(1X,E14.8,1H,)))                                                    S0316970
9012 FORMAT (1H0,9X,53HNUMBER OF SOURCES IN EACH CONCENTRATION REPORT GS0316980
     1ROUP 1 TO ,I3,2H =,11(I4,1H,)/(1X,26(I4,1H,)))                      S0316990
9013 FORMAT (10X,45HSOURCE NUMBERS FOR EACH OF THE ABOVE GROUPS =,9(I7,S0317000
     11H,)/(1X,16(I7,1H,)))                                               S0317010
9014 FORMAT (50X,20H- SOURCE INVENTORY -/22H C T SOURCE T   SOURCE,7X,1S0317020
     1HX,10X,1HY,6X,85HHEIGHT  IF TYPE=0    IF TYPE=0    ANGLE   STACK  S0317030
     2 ELEVATION  PARTICULATE DISTRIBUTION/94H A A NUMBER Y  STRENGTH  CS0317040
     3OORDINATE COORDINATE  ABOVE  TEMP (DEG K) VOL. EMISS.    TO    INNS0317050
     4ER,7X,2HAT,7X,20HSETTLING   FREQUENCY/4H R P,8X,1HP,3A4,13H (METERS0317060
     5S)  (,A4,A3,59H) GROUND  IF TYPE=1OR2 RT. M**3/SEC  LONG   RADIUSS0317070
     6    STACK,6X,5HVELOCITY,7X,2HOF/4H D E,8X,1HE,33X,85H(METERS) LENGS0317080
     7TH SHORT IF TYPE=1OR2  SIDE  (METERS)    BASE    (METERS/SEC) OCCUS0317090
     8RRENCE/55X,31HSIDE (MTRS)  LENGTH LONG  (DEG),12X,8H(METERS),15X,1S0317100
     90H(FRACTION)/68X,11HSIDE (MTRS)/1X,65(2H--))                      S0317110
 9015 FORMAT (2(1X,A1),I7,I2,F11.3,2F11.2,F9.2,F10.3,F13.3,F9.1,F9.3,F10S0317120
     1.2,F11.3,F13.5)                                                   S0317130
 9016 FORMAT (104X,2F12.7)                                              S0317140
 9017 FORMAT(130H HOUR    WIND      WIND     LAYER   AMBIENT  VERT GRAD S0317150
     1STAB  WND SPD    STD DEV EL  STD DEV AZ  STD DEV EL  STD DEV AZ   S0317160
     2  LATERAL/130H      DIRECTION   SPEED    DEPTH     TEMP   OF POT TS0317170
     3MP ILITY POWER LAW  ANGLE, SOR  ANGLE, SOR  ANGLE, SOR  ANGLE, SORS0317180
     4   DIFFUSION/131H       (DEGREES) (MTR/SEC) (METERS) (DEG K)  (DEG S0317190
     5K/M)  CAT.  EXPONENT      TYPE 0      TYPE 0     TYPE 1OR2   TYPE 1S0317200
     6OR2  COEFFICIENT/8X,5HTHETA,6X,4HUBAR,6X,2HHM,7X,2HTA,6X,19HDPDZ  S0317210
     7  ISTBLE     P,6X,57HSIGEPU(RAD) SIGAPU(RAD) SIGEPL(RAD) SIGAPL(RADS0317220
     8)      ALPHA/1X,65(2H--))                                         S0317230
 9018 FORMAT (1X,I4,2F9.4,F10.3,F9.3,F9.4,4X,A1,5X,F7.4,4F12.7,5X,F7.4) S0317240
 9019 FORMAT (1H0,41X,43H*-* COORDINATES OF DISCRETE POINTS (METERS,,A4,S0317250
     1A3,4H)*-*//(8H (X,Y) =,5(2H (,F9.1,1H,,F10.1,2H),)))              S0317260
 9020 FORMAT (I6,4F10.0)                                                S0317270
 9021 FORMAT (22H *** WARNING - SOURCE ,I5,46H TEMP LESS THAN AMBIENT, PS0317280
     1ROG USES AMBIENT ***)                                             S0317290
 9022 FORMAT (10X,36HELEVATION OF BASE OF WEATHER STATION,23X,5H(HA) =,FS0317300
     18.2,7X,8H(METERS)/10X,29HX ORIGIN OF POLAR COORDINATES,29X,8H(UTMXS0317310
     2) =,F10.2,5X,8H(METERS)/10X,29HY ORIGIN OF POLAR COORDINATES,28X,8S0317320
     3H(UTMY) =,F10.2,5X,8H(METERS))                                    S0317330
 9023 FORMAT (27H **-WARNING Z > HM, SOURCE ,I5,7H, HOUR ,I4,4H, X=,F10.S0317340
     11,4H, Y=,F10.1)                                                   S0317350
 9024 FORMAT (46H0** TOO MANY MESSAGES PROG STOPS PRINTING THEM)        S0317360
 9025 FORMAT (' SOURCE NO. =',I6,', Q=',E12.6,', TS=',E12.6,', VOL=',E12S0317370
     1.6)                                                               S0317390
 9026 FORMAT (55H0*** ERROR, SIGAPU OR SIGEPU IS ZERO, CORRECT AND RERUNS0317390
     1)                                                                 S0317400
 9027 FORMAT (55H0*** ERROR, SIGAPL OR SIGEPL IS ZERO, CORRECT AND RERUNS0317410
     1)                                                                 S0317420
 9028 FORMAT (43H0*** ERROR, UBAR INPUT AS ZERO, PROG. STOPS)           S0317430
 9029 FORMAT (47H0*** ERROR, HM INPUT AS ZERO, CORRECT AND RERUN)       S0317140
 9030 FORMAT (47H0*** ERROR, TA INPUT AS ZERO, CORRECT AND RERUN)       S0317450
 9031 FORMAT (59H0*** WARNING, P INPUT AS ZERO, PROG USES ZERO AND CONTIS0317460
     1NUES)                                                             S0317470
 9032 FORMAT (37H0*** ERROR, ATTEMPT TO MODIFY SOURCE ,I5,22H, BUT SOURCS0317480
     1E NOT FOUND)                                                     S0317490
 9033 FORMAT (41H0*** ERROR, VARIABLE Q'S READ FOR SOURCE ,I5,49H, BUT SS0317500
     1OURCE NOT IN INVENTORY, SEE CARD GROUP 11A)                      S0317510
 9034 FORMAT (41H0*** ERROR, VARIABLE Q'S READ FOR SOURCE ,I5,34H, BUT JS0317520
     1FLG ON SOURCE CARD WAS ZERO)                                     S0317530
 9035 FORMAT (41H0*** ERROR, VARIABLE Q'S READ FOR SOURCE ,I5,37H, BUT NS0317540
     1O CHANGES INDICATED FOR SOURCE)                                  S0317550
 9036 FORMAT (40H *** ERROR, JFLG IS NON-ZERO FOR SOURCE ,I5,27H, BUT NOS0317560
     1 VARIABLE Q'S FOUND)                                             S0317570
 9037 FORMAT (29H0*** ERROR, NEW Q FOR SOURCE ,I5,39H READ, BUT CANNOT FS0317580
     1IND OLD VARIABLE Q'S)                                            S0317590
 9038 FORMAT (10X,34HIS THE FORMAT FOR SOURCE DATA READ,21X,10H(ISW(12))S0317600
     1=,I5/10X,49HIS COORDINATE SYSTEM CARTESIAN (=0) OR POLAR (=1),6X,1S0317610
     20H(ISW(13))=,I5/10X,51HARE DISCRETE RECEPTORS CARTESIAN (=0) OR POS0317620
     3LAR (=1),4X,10H(ISW(14))=,I5/10X,51HARE SOURCE COORDINATES CARTESIS0317630
     4AN (=0) OR POLAR (=1),4X,10H(ISW(15))=,I5/10X,36HSIGEPU SIGAPU FORS0317640
     5 ALL SOURCES OPTION,19X,10H(ISW(16))=,I5/10X,43HRURAL/URBAN MODE OS0317650
     6PTION (RURAL=0),(URBAN=1),12X,10H(ISW(17))=,I5)                  S0317660
 9039 FORMAT (59H0*** ERROR, SIGEPU OR SIGEPL IS LESS THAN OR EQUAL TO ZS0317670
     1ERO)                                                             S0317680
 9040 FORMAT (59H0*** ERROR, SIGAPU OR SIGAPL IS LESS THAN OR EQUAL TO ZS0317690
     1ERO)                                                             S0317700
 9041 FORMAT (86H ** WARNING - COMPLEX TERRAIN SWITCH SET WITH DEPOSITIOS0317710
     1N (NS). COMPLEX TERRAIN IGNORED)                                 S0317720
      END                                                              S0317730
      SUBROUTINE OUTPT(M,K,X,Y,CON)                                     S0400000
C$    PARAMETER MKQ CONTROLS THE AMOUNT OF CORE STORAGE AVAILABLE FOR   S0400010
C$    THE SOURCES. THIS PARAMETER IS NORMALLY SET TO 300. HOWEVER IT    S0400020
C$    CAN BE INCREASED IF NECESSARY. IF YOU ARE USING TAPE INPUT MKQ    S0400030
C$    MUST BE THE SAME VALUE IT WAS SET TO WHEN THE TAPE WAS WRITTEN.   S0400040
C$    ALSO, IF YOU MODIFY MKQ AND WRITE A TAPE MAKE SURE TO MAKE NOTE   S0400050
C$    OF THE CHANGE ON THE TAPE. CHECK SUBROUTINE OUTPT ALSO.           S0400060
C                                                                       S0400070
      PARAMETER MKQ=300                                                 S0400080
C                                                                       S0400090
C$           (MAXIMUM MKQ = 1000.                                       S0400100
C$                                                                      S0400110
C$                                                                      S0400120
      INTEGER TITLE,HOUR,DATS                                           S0400130
C                                                                       S0400140
      DIMENSION NHR(2),X(1),Y(1),CON(1)                                 S0400150
C                                                                       S0400160
      COMMON /DIM/ NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NHOURS,NDAYS      S0400170
     1,IOVRSN                                                           S0400180
      COMMON /MET/ THETA,UBAR,HM,TA,DPDZ,ISTBLE,P,SIGEPU,SIGAPU,SIGEPL, S0400190
     1SIGAPL,ALPHA,HOUR,NUMSQB(MKQ),QB(MKQ),TSB(MKQ),VOLB(MKQ)          S0400200
      COMMON /RST/ ISW(20),TITLE(20),KUNR(5),KFNR(3),DD1(3),I3,DATS(2), S0400210
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0400220
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0400230
C                                                                       S0400240
      EQUIVALENCE (NHR(1),THETA),(KS,HM),(L1,TA),(L2,DPDZ),(L3,ISTBLE), S0400250
     1(LX,P),(LY,SIGEPU),(J4,SIGAPU),(J3,SIGEPL),(I1,SIGAPL),(I2,ALPHA) S0400260
C                                                                       S0400270
C     THIS SUBROUTINE PRINTS GROUND LEVEL CONCENTRATION                 S0400280
C                                                                       S0400290
      NXXYY = NXPNTS*NYPNTS+NXWYPT                                      S0400300
C     IF AVERAGED OVER NDAYS DIVIDE BY NDAYS                            S0400310
      IF (ISW(11) .EQ. 0.OR.M .EQ. 99) GO TO 10                         S0400320
      DD4 = 1.0/FLOAT(NDAYS)                                            S0400330
      CALL ACM(CON,DD4,NXXYY)                                           S0400340
   10 CONTINUE                                                          S0400350
      IF (M .EQ. 99) GO TO 20                                           S0400360
      KS = ISW(K+1)                                                     S0400370
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C                                                                       S0400380
C$$$$                                                                   S0400390
C     THIS CODING ASSUMES A 36 BIT WORD, 6 INTEGER VALUES PER WORD,     S0400400
C     6 BITS PER VALUE.                                                 S0400410
      I = IABS(IH-1)*6                                                  S0400420
      J = MOD(I,36)                                                     S0400430
      I = I/36+1                                                        S0400440
      NHR(2) = 0                                                        S0400450
C     TAKE 6 BITS FROM IHOUT(I) STARTING AT BIT J+1 AND STORE THEM INTO S0400460
C     NHR(2) STARTING AT BIT 31. THE REST OF NHR(2) IS UNCHANGED. BITS  S0400470
C     ARE COUNTED FROM THE LEFT STARTING WITH BIT 1 (SIGN BIT).         S0400480
      BITS(NHR(2),31,6) = BITS(IHOUR(I),J+1,6)                          S0400490
C$$$$                                                                   S0400500
      NHR(2) = NHR(2)*100                                               S0400510
      NHR(1) = NHR(2)-(ISW(K+1)-1)*100                                  S0400520
      IF (NHR(1) .LT. 0) NHR(1) = NHR(1)+2400                           S0400530
   20 CONTINUE                                                          S0400540
      INT = 1                                                           S0400550
      IF (M .EQ. 99) GO TO 30                                           S0400560
      INT = 0                                                           S0400570
      XBL = FLOAT(IB-5)/14.0                                            S0400580
      IF (XBL .LT. 0.0) XBL = 0.0                                       S0400590
      IBL = XBL                                                         S0400600
      IF (XBL .GT. FLOAT(IBL)) IBL = IBL+1                              S0400610
   30 CONTINUE                                                          S0400620
      ITC = 0                                                           S0400630
      IF (NXPNTS .LE. 0) GO TO 200                                      S0400640
      IF (M .EQ. 99) GO TO 50                                           S0400650
      CMAX = -1.0                                                       S0400660
      DO 40 J=1,NYPNTS                                                  S0400670
      I2 = (J-1)*NXPNTS                                                 S0400680
      DO 40 I=1,NXPNTS                                                  S0400690
      IF (CON(I+I2) .LE. CMAX) GO TO 40                                 S0400700
      CMAX = CON(I+I2)                                                  S0400710
      XMAX = X(I)                                                       S0400720
      YMAX = Y(J)                                                       S0400730
   40 CONTINUE                                                          S0400740
C     PRINT 9 X AXIS POINTS ACROSS PAGE                                 S0400750
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   50 CONTINUE                                                          S0400760
      L = 1                                                             S0400770
      IF (ISW(13) .NE. 0) L = 3                                         S0400780
      IF (INT .NE. 1) INT = 4                                           S0400790
      J = 0                                                             S0400800
      I2 = 0                                                            S0400810
   60 I1 = I2+1                                                         S0400820
      IF (I1 .GT. NXPNTS) GO TO 200                                     S0400830
      I2 = I1+8                                                         S0400840
      IF (I2 .GT. NXPNTS) I2 = NXPNTS                                   S0400850
      J3 = NYPNTS+1                                                     S0400860
   70 J3 = J3-1                                                         S0400870
      IF (J3 .EQ. 0) GO TO 170                                          S0400880
      IF (J .NE. 0) GO TO 180                                           S0400890
      CALL TITLR(ITC,1,INT)                                             S0400900
      ITC = 1                                                           S0400910
      IF (IPC .EQ. 0) GO TO 160                                         S0400920
      IF (INT .EQ. 1) LINE = LINE+1                                     S0400930
   80 IF (M .EQ. 99) GO TO 120                                          S0400940
      IF (M .EQ. 1) GO TO 90                                            S0400950
      WRITE (JUNT,9001) KS,KUNR,(IPRT(I),I=1,IB)                        S0400960
      LINE = LINE+IBL+1                                                 S0400970
      GO TO 100                                                         S0400980
   90 WRITE (JUNT,9002) KS,KUNR                                         S0400990
      LINE = LINE+1                                                     S0401000
  100 IF (ISW(11) .EQ. 0) GO TO 110                                     S0401010
      WRITE (JUNT,9012) NDAYS                                           S0401020
      LINE = LINE+1                                                     S0401030
  110 WRITE (JUNT,9003) NHR(1),NHR(2)                                   S0401040
      LINE = LINE+3                                                     S0401050
      GO TO 130                                                         S0401060
  120 WRITE (JUNT,9007)                                                 S0401070
      LINE = LINE+2                                                     S0401080
      GO TO 140                                                         S0401090
  130 WRITE (JUNT,9004) CMAX,XMAX,YMAX,(X(I),I=I1,I2)                   S0401100
      LINE = LINE+3                                                     S0401110
      WRITE (JUNT,9006) MUNT(L),MUNT(L+1)                               S0401120
      GO TO 150                                                         S0401130
  140 WRITE (JUNT,9016) (X(I),I=I1,I2)                                  S0401140
      LINE = LINE+2                                                     S0401150
      WRITE (JUNT,9008) MUNT(L),MUNT(L+1)                               S0401160
  150 LINE = LINE+3                                                     S0401170
  160 JS = (J3-1)*NXPNTS                                                S0401180
      WRITE (JUNT,9005) Y(J3),(CON(JS+I),I=I1,I2)                       S0401190
      GO TO 70                                                          S0401200
  170 IF (11+LINE .LE. NLINES) GO TO 190                                S0401210
      LINE = NLINES                                                     S0401220
      GO TO 60                                                          S0401230
  180 WRITE (JUNT,9014)                                                 S0401240
      LINE = LINE+3                                                     S0401250
      J = 0                                                             S0401260
      IF (M .EQ. 99) GO TO 140                                          S0401270
      GO TO 130                                                         S0401280
  190 J = 1                                                             S0401290
      GO TO 60                                                          S0401300
  200 CONTINUE                                                          S0401310
      IF (NXWYPT .LE. 0) GO TO 350                                      S0401320
  210 J3 = NXPNTS*NYPNTS                                                S0401330
      L = 1                                                             S0401340
      IF (ISW(14) .NE. 0) L = 3                                         S0401350
      NIJ = NXPNTS+NYPNTS                                               S0401360
      NJI = NYPNTS+NXWYPT                                               S0401370
      IF (M .EQ. 99) GO TO 230                                          S0401380
      CMAX = -1.0                                                       S0401390
      DO 220 I=1,NXWYPT                                                 S0401400
      IF (CON(I+J3) .LE. CMAX) GO TO 220                                S0401410
      CMAX = CON(I+J3)                                                  S0401420
      XMAX = X(I+NIJ)                                                   S0401430
      YMAX = Y(I+NJI)                                                   S0401440
  220 CONTINUE                                                          S0401450
  230 CONTINUE                                                          S0401460
      XBL = FLOAT(NXWYPT)/3.0                                           S0401470
      I1 = XBL                                                          S0401480
      IF (XBL .GT. FLOAT(I1)) I1 = I1+1                                 S0401490
      I = -2                                                            S0401500
      IF (INT .NE. 1) INT = 4                                           S0401510
      IF (NXPNTS .GT. 0) GO TO 250                                      S0401520
  240 LINE = NLINES                                                     S0401530
      GO TO 270                                                         S0401540
  250 IF (LINE+14 .LE. NLINES) GO TO 260                                S0401550
      GO TO 240                                                         S0401560
  260 WRITE (JUNT,9014)                                                 S0401570
      LINE = LINE+2                                                     S0401580
      IF (M .EQ. 99) GO TO 320                                          S0401590
      GO TO 310                                                         S0401600
  270 I = I+3                                                           S0401610
      IF (I .GT. NXWYPT) GO TO 350                                      S0401620
      J4 = I+2                                                          S0401630
      IF (J4 .GT. NXWYPT) J4 = NXWYPT                                   S0401640
      CALL TITLR(ITC,1,INT)                                             S0401650
      ITC = 1                                                           S0401660
      I2 = 1                                                            S0401670
      IF (IPC .EQ. 0) GO TO 340                                         S0401680
      IF (INT .EQ. 1) LINE = LINE+2                                     S0401690
      IF (M .EQ. 99) GO TO 320                                          S0401700
      IF (M .EQ. 1) GO TO 280                                           S0401710
      WRITE (JUNT,9001) KS,KUNR,(IPRT(J),J=1,IB)                        S0401720
      LINE = LINE+IBL+1                                                 S0401730
      GO TO 290                                                         S0401740
  280 WRITE (JUNT,9002) KS,KUNR                                         S0401750
      LINE = LINE+1                                                     S0401760
  290 IF (ISW(11) .EQ. 0) GO TO 300                                     S0401770
      WRITE (JUNT,9012) NDAYS                                           S0401780
      LINE = LINE+1                                                     S0401790
  300 WRITE (JUNT,9003) NHR(1),NHR(2)                                   S0401800
      LINE = LINE+3                                                     S0401810
  310 WRITE (JUNT,9015) CMAX,XMAX,YMAX                                  S0401820
      LINE = LINE+1                                                     S0401830
      WRITE (JUNT,9009) (MUNT(L),MUNT(L+1),J=1,3)                       S0401840
      GO TO 330                                                         S0401850
  320 WRITE (JUNT,9013)                                                 S0401860
      WRITE (JUNT,9010) (MUNT(L),MUNT(L+1),J=1,3)                       S0401870
  330 LINE = LINE+6                                                     S0401880
      IF (I .LT. 0) GO TO 270                                           S0401890
  340 WRITE (JUNT,9011) (X(NIJ+J),Y(NJI+J),CON(I3+J),J=I,I4)           S0401900
      GO TO 270                                                         S0401910
  350 CONTINUE                                                          S0401920
      RETURN                                                            S0401930
 9001 FORMAT (18X,I4,33H HOUR GROUND LEVEL CONCENTRATION ,6A4,13H FROM SS0401940
     1OURCES,5(A1,I6)/(20X,14(A1,I6)))                                  S0401950
 9002 FORMAT (18X,I4,33H HOUR GROUND LEVEL CONCENTRATION ,6A4,17H FROM AS0401960
     1LL SOURCES)                                                       S0401970
 9003 FORMAT (1H0,52X,9H- HOUR(S),I5,3H TO,I5,2H -/)                    S0401980
 9004 FORMAT (50X,31H- GRID SYSTEM X AXIS (METERS) -/30X,30H(THE MAXIMUMS0401990
     1 CONCENTRATION IS ,F13.7,6H AT X=,F9.1,4H, Y=,F9.1,1H)/13X,9F13.3)S0402000
 9005 FORMAT (1X,F13.3,1X,9F13.7)                                       S0402010
 9006 FORMAT (1X,9HY AXIS (,A4,A3,1H),43X,19H-  CONCENTRATION  -/14X,29(S0402020
     14H----)/)                                                         S0402030
 9007 FORMAT (44X,44H*-* GRID SYSTEM TERRAIN HEIGHTS (METERS) *-*/)     S0402040
 9008 FORMAT (1X,9HY AXIS (,A4,A3,1H),43X,10H- HEIGHT -/14X,29(4H----)/)S0402050
 9009 FORMAT (1H0,3(4X,1HX,9X,1HY,6X,13HCONCENTRATION,6X)/1X,3(12H (METES0402060
     1RS)  (,A4,A3,1H),20X)/14X,58(2H--)/)                              S0402070
 9010 FORMAT (1H0,3(4X,1HX,9X,1HY,9X,6HHEIGHT,10X)/1X,3(12H (METERS)  (,S0402080
     1A4,A3,1H),20X)/14X,58(2H--)/)                                     S0402090
 9011 FORMAT (3(1X,F9.1,F11.1,F14.7,5X))                                S0402100
 9012 FORMAT (54X,14HAVERAGED OVER ,I3,5H DAYS)                         S0402110
 9013 FORMAT (42X,47H*-* DISCRETE POINT TERRAIN HEIGHTS (METERS) *-*)   S0402120
 9014 FORMAT (/)                                                        S0402130
 9015 FORMAT (52X,29H- DISCRETE POINT RECEPTORS -/30X,30H(THE MAXIMUM COS0402140
     1NCENTRATION IS,F13.7,6H AT X=,F9.1,4H, Y=,F9.1,1H))               S0402150
 9016 FORMAT (50X,31H- GRID SYSTEM X AXIS (METERS) -/13X,9F13.3)        S0402160
      END                                                               S0402170
      SUBROUTINE INPOUP(I,ADR1,ADR2)                                    S0500000
C                                                                       S0500010
      INTEGER TITLE,DATS,ADR2                                           S0500020
C                                                                       S0500030
      DIMENSION XEND(14),ADR1(1),BUFIN(2000),BUFOT(2000,2),IXEND(14)    S0500040
C                                                                       S0500050
      COMMON /DIM/ NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NHOURS,NDAYS      S0500060
     1,IOVRSN                                                           S0500070
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0500080
      COMMON /RST/ ISW(20),TITLE(20),KUNR(6),KFNR(3),DD1(3),I3,DATS(2), S0500090
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0500100
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0500110
C                                                                       S0500120
      EQUIVALENCE (XEND,IXEND),(JOVRSN,XOVRSN),(IVSN,XVSN)              S0500130
C                                                                       S0500140
C     CURRENT VERSION OF INPOUP + 9900                                  S0500150
      DATA JOVRSN/9903/                                                 S0500160
C$$$$                                                                   S0500170
C     IXEND (XEND) IS THE UNIVAC END OF TAPE SENTINAL RECORD AND ASSUMESS0500180
C     A 36 BIT WORD.                                                    S0500190
      DATA IXEND/0541600000000,13*0/,NI,NO,ISREC/3*1/,IT1REC,IT2REC,NOB,S0500200
     1IEND,LSW,IWRD/6*0/,NIB,NWRD/2*2000/,XFT/0.0/                      S0500210
C$$$$                                                                   S0500220
C                                                                       S0500230
C     I/O VERSION 1 OF THIS ROUTINE WAS UNBLOCKED RECORDS AND IS TURNED S0500240
C     ON BY SETTING LSW=1. I/O VERSION 2 WAS THE UNIVAC @FOR FORTRAN    S0500250
C     COMPILER. I/O VERSION 3 IS THE UNIVAC @FTN FORTRAN COMPILER.      S0500260
C                                                                       S0500270
      NOGO = 0                                                          S0500280
      IF (I .EQ. 2) GO TO 200                                           S0500290
      IF (I .EQ. 3) GO TO 350                                           S0500300
      IF (LSW .EQ. 0) GO TO 20                                          S0500310
      IT1REC = IT1REC+1                                                 S0500320
C     READ TAPE NINFL(NI), 22=CLEAR I/O, 2=READ, ADR2=NO. OF WORDS IN,  S0500330
C     BUFFER, ADR1=BUFFER, IEOF=I/O STATUS - -1=TRANSMISSION NOT COMLETES0500340
C     -2=EOT, -3 OR -4=ERROR, 0=EOF, >0= NO. OF WORDS READ.             S0500350
      CALL NTRAN$(NINFL(NI),22,2,ADR2,ADR1,IEOF)                        S0500360
   10 IF (IEOF .GT. 0) GO TO 370                                        S0500370
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      IF (IEOF .EQ. -1) GO TO 10                                        S0500380
      IF (IEOF .EQ. -2) GO TO 180                                       S0500390
      GO TO 190                                                         S0500400
   20 N = 0                                                             S0500410
   30 N = N+1                                                           S0500420
      IF (N .GT. ADR2) GO TO 370                                        S0500430
   40 NIB = NIB+1                                                       S0500440
      IF (NIB .GT. IWR)) GO TO 80                                       S0500450
      ADR1(N) = BUFIN(NIB)                                              S0500460
C     CHECK WHICH VERSION WROTE TAPE, VERSION 9902 (9FOR) OR 9903 (9FTN)S0500470
      IF (I .GT. 0) GO TO 30                                            S0500480
      IF (ADR2 .NE. 8) GO TO 50                                         S0500490
      IF (N .LT. 9) GO TO 30                                            S0500500
      XVSN = ADR1(N)                                                    S0500510
      IF (ADR1(N) .EQ. XOVRSN) GO TO 30                                 S0500520
      IVSN = 9902                                                       S0500530
      NIB = NIB-1                                                       S0500540
      IOVRSN = JOVRSN                                                   S0500550
      GO TO 30                                                          S0500560
   50 IF (IVSN .EQ. JOVRSN) GO TO 30                                    S0500570
      IF (ADR2 .NE. 49.OR.N .LT. 49) GO TO 30                           S0500580
      NIB = NIB-13                                                      S0500590
C     CONVERT FIELDATA CHARACTERS TO ASCII, K WORDS                     S0500600
      K = 2                                                             S0500610
      CALL FFDASC(K,TITLE(15),KFNR(1))                                  S0500620
      K = 4                                                             S0500630
      CALL FFDASC(K,TITLE(11),KUNR(1))                                  S0500640
      DO 60 K=1,10                                                      S0500650
   60 TITLE(21-K) = TITLE(11-K)                                         S0500660
C     CONVERT FIELDATA CHARACTERS (6 PER WORD) TO ASCII CHARACTERS      S0500670
C     (4 PER WORD), 10 WORDS.                                           S0500680
      K = 10                                                            S0500690
      CALL FFDASC(K,TITLE(11),TITLE(1))                                 S0500700
      DO 70 K=16,20                                                     S0500710
   70 TITLE(K) = IBLNK                                                  S0500720
      GO TO 30                                                          S0500730
   80 JSW = 1                                                           S0500740
      IEND = 0                                                          S0500750
      IT1REC = IT1REC+1                                                 S0500760
      NIB = 0                                                           S0500770
C     READ TAPE                                                         S0500780
   90 CALL NTRAN#(NINFL(NI),22,2,NWRD,BUFIN,IEOF)                       S0500790
  100 IF (IEOF .GT. 0) GO TO 130                                        S0500800
      IF (IEOF .EQ. -1) GO TO 100                                       S0500810
      IF (IEOF .EQ. -2) GO TO 110                                       S0500820
      IF (JSW .EQ. 2) GO TO 150                                         S0500830
      IF (IEND .EQ. 1) GO TO 160                                        S0500840
C     READ ERROR                                                        S0500850
      WRITE (JUNT,9001) NINFL(NI),IT1REC                                S0500860
      LINE = 200                                                        S0500870
      GO TO 190                                                         S0500880
  110 IF (JSW .EQ. 2) GO TO 150                                         S0500890
      IEND = IEND+1                                                     S0500900
      IF (IEND .GT. 1) GO TO 120                                        S0500910
      IT1REC = IT1REC-1                                                 S0500920
      IF (IT1REC .LE. 0) GO TO 80                                       S0500930
      GO TO 90                                                          S0500940
  120 WRITE (JUNT,9002) NINFL(NI),IT1REC                                S0500950
      LINE = 200                                                        S0500960
      GO TO 180                                                         S0500970
  130 IWRD = IEOF                                                       S0500980
      IF (IT1REC .GT. 1) GO TO 140                                      S0500990
      IF (IEOF .NE. NWRD) LSW = 1                                       S0501000
  140 IF (JSW .EQ. 2) GO TO 160                                         S0501010
      IF (IEND .EQ. 0) GO TO 40                                         S0501020
C     CHECK FOR END OF REEL SENTINEL FOR MULTIPLE REEL FILE             S0501030
      IF (BUFIN(1) .NE. XEND(1)) GO TO 160                              S0501040
      IF (IEOF .NE. 14) GO TO 160                                       S0501050
      JSW = 2                                                           S0501060
      GO TO 90                                                          S0501070
C     END MULTIPLE REEL FILE, 22=CLEAR I/O, 11=REWIND AND INTERLOCK     S0501080
  150 CALL NTRAN#(NINFL(NI),22,11,22,22,22)                             S0501090
      NI = NI+1                                                         S0501100
      IF (NI .GT. NINTP) GO TO 170                                      S0501110
      GO TO 80                                                          S0501120
  160 WRITE (JUNT,9003) NINFL(NI),IT1REC                                S0501130
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          LINE = LINE+2                                                 S0501140
C         POSITION TAPE BY BLOCKS, 22=CLEAR I/O, 7=MOVE BLOCKS, -1=BACK ONE S0501150
C         BLOCK.                                                        S0501160
          CALL NTRAN$(NINFL(NI),22,7,-1,22,22)                          S0501170
          GO TO 180                                                     S0501180
      170 WRITE (JUNT,9004)                                             S0501190
          LINE = LINE+2                                                 S0501200
          NI = 1                                                        S0501210
          GO TO 80                                                      S0501220
      180 NOGO = 1                                                      S0501230
          IT1REC = 0                                                    S0501240
          LSW = 0                                                       S0501250
          IWRD = 0                                                      S0501260
          NIB = 2000                                                    S0501270
          GO TO 370                                                     S0501280
      190 NOGO = 2                                                      S0501290
          IF (IT2REC .LE. 0) GO TO 370                                  S0501300
          GO TO 360                                                     S0501310
      200 JSW = 1                                                       S0501320
          N = 0                                                         S0501330
      210 N = N+1                                                       S0501340
          IF (N .GT. ADR2) GO TO 370                                    S0501350
      220 NOB = NOB+1                                                   S0501360
          IF (NOB .GT. NWRD) GO TO 230                                  S0501370
          BUFOT(NOB,2) = ADR1(N)                                        S0501380
          GO TO 210                                                     S0501390
      230 IT2REC = IT2REC+1                                             S0501400
      240 IF (NOB .GT. NWRD) NOB = NWRD                                 S0501410
          IF (NOB .LT. 4) NOB = 4                                       S0501420
C         WRITE TAPE NOTFL(NO), 22=CLEAR I/O, 1=WRITE, NOB=NO. OF WORDS,    S0501430
C         BUFOT(1,2)=BUFFER, IEOF=I/O STATUS - -1=TRANSMISSION NOT COMPLETE S0501440
C         -2=EOT, -3 OR -4=ERROR.                                       S0501450
          CALL NTRAN$(NOTFL(NO),22,1,NOB,BUFOT(1,2),IEOF)               S0501460
      250 IF (IEOF .GT. 0) GO TO 330                                    S0501470
          IF (IEOF .EQ. -1) GO TO 250                                   S0501480
          IF (IEOF .EQ. -2) GO TO 270                                   S0501490
C         WRITE ERROR                                                   S0501500
      260 WRITE (JUNT,9005) NOTFL(NO),IT2REC                            S0501510
      LINE = 200                                                        S0501520
      GO TO 190                                                         S0501530
C     END OF TAPE MARK ENCOUNTERED                                      S0501540
  270 IF (NO+1 .LE. NOTTP) GO TO 280                                    S0501550
      WRITE (JUNT,9006)                                                 S0501560
      LINE = LINE+2                                                     S0501570
      NOGO = 2                                                          S0501580
      GO TO 370                                                         S0501590
  280 IF (IT2REC .GT. 2) GO TO 310                                      S0501600
      WRITE (JUNT,9009) NOTFL(NO)                                       S0501610
      LINE = LINE+2                                                     S0501620
      NO = NO+1                                                         S0501630
      IF (NO .GT. NOTTP) GO TO 270                                      S0501640
      IF (IT2REC .LE. 1) GO TO 300                                      S0501650
C     WRITE TAPE NOTFL(NO)                                              S0501660
      CALL NTRAN$(NOTFL(NO),22,1,NWRD,BUFOT(1,1),IEOF)                  S0501670
  290 IF (IEOF .GT. 0) GO TO 300                                        S0501680
      IF (IEOF .EQ. -1) GO TO 290                                       S0501690
      IT2REC = 1                                                        S0501700
      GO TO 260                                                         S0501710
  300 IT2REC = 0                                                        S0501720
      GO TO 230                                                         S0501730
C     MOVE TAPE NOTFL(NO) BACK 2 BLOCKS                                 S0501740
  310 CALL NTRAN$(NOTFL(NO),22,7,-2,22,22)                              S0501750
C     WRITE AN EOF ON TAPE NOTFL(NO)                                    S0501760
      CALL NTRAN$(NOTFL(NO),22,9,22,22,22)                              S0501770
C     WRITE END OF TAPE SENTINEL ON NOTFL(NO), 14 WORDS FROM XEND.      S0501780
      CALL NTRAN$(NOTFL(NO),22,1,14,XEND,IEOF)                          S0501790
C     WRITE 2 EOF MARKS AND REWIND/INTERLOCK (11) NOTFL(NO)             S0501800
      CALL NTRAN$(NOTFL(NO),22,9,9,11,22)                               S0501810
      IT2REC = IT2REC-2                                                 S0501820
      WRITE (JUNT,9007) NOTFL(NO),ISREC,IT2REC                          S0501830
      LINE = LINE+2                                                     S0501840
      NO = NO+1                                                         S0501850
      IF (NO .GT. NOTTP) GO TO 270                                      S0501860
      XFT = FLOAT(NWRD)*0.005625+0.75                                   S0501870
      IT2REC = IT2REC+1                                                 S0501880
      ISREC = IT2REC                                                    S0501890
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C     WRITE TAPE NOTFL(NO)                                              S0501900
      CALL NTRANS(NOTFL(NO),22,1,NWRD,BUFOT(1,1),IEOF)                  S0501910
  320 IF (IEOF .GT. 0) GO TO 230                                        S0501920
      IF (IEOF .EQ. -1) GO TO 320                                       S0501930
      GO TO 260                                                         S0501940
  330 XFT = XFT+FLOAT(NWRD)*0.005625+0.75                               S0501950
      NOB = 0                                                           S0501960
      IF (JSW .NE. 1) GO TO 360                                         S0501970
      DO 340 J=1,NWRD                                                   S0501980
  340 BUFOT(J,1) = BUFOT(J,2)                                           S0501990
      GO TO 220                                                         S0502000
  350 JSW = 2                                                           S0502010
      IF (NOB .GT. 0) GO TO 230                                         S0502020
C     CLOSE OUTPUT FILE, WRITE 2 EOF MARKS AND POSITION TAPE BETWEEN    S0502030
C     THEM.                                                             S0502040
  360 CALL NTRANS(NOTFL(NO),22,9,9,8,-1)                                S0502050
      XFT = (XFT+12.0)/12.0                                             S0502060
      WRITE (JUNT,9008) NOTFL(NO),ISREC,IT2REC,XFT                      S0502070
      LINE = LINE+1                                                     S0502080
  370 CONTINUE                                                          S0502090
      RETURN                                                            S0502100
 9001 FORMAT (24H1*** READ ERROR ON UNIT ,I2,11H AT RECORD ,I6/)        S0502110
 9002 FORMAT (25H1*** END OF DATA ON UNIT ,I2,2H, ,I5,13H RECORDS READ/)S0502120
 9003 FORMAT (25H0*** END OF FILE ON UNIT ,I2,2H, ,I5,13H RECORDS READ/)S0502130
 9004 FORMAT (86H0*** WARNING - MORE INPUT REELS THAN UNITS ASSIGNED PROS0502140
     1G. GOING TO FIRST UNIT ASSIGNED/)                                 S0502150
 9005 FORMAT (25H1*** WRITE ERROR ON UNIT ,I2,11H AT RECORD ,I5/)       S0502160
 9006 FORMAT (71H0*** ERROR - MORE OUTPUT REELS REQUIRED THAN UNITS ASSIS0502170
     1GNED, PROG STOPS)                                                 S0502180
 9007 FORMAT (32H0*** END OF OUTPUT REEL ON UNIT ,I2,9H RECORDS ,I6,9H TS0502190
     1HROUGH ,I6,8H WRITTEN/)                                           S0502200
 9008 FORMAT (32H *** END OF OUTPUT DATA ON UNIT ,I2,9H RECORDS ,I6,9H TS0502210
     1HROUGH ,I6,10H WRITTEN, ,F9.3,13H FEET OF TAPE USED/)             S0502220
 9009 FORMAT (47H0*** WARNING - NOT ENOUGH ROOM ON REEL ON UNIT ,I2,44H S0502230
     1PROG. STARTS FIRST OUTPUT REC. ON NEXT REEL/)                     S0502240
      END                                                               S0502250
      SUBROUTINE TITLR(IFLG1,IFLG2,IFLG3)                               S0600000
C                                                                       S0600010
      INTEGER TITLE,DATS                                                S0600020
C                                                                       S0600030
      DIMENSION ICONT1(2),ICONT2(2),ICONT(2)                            S0600040
C                                                                       S0600050
      COMMON /RST/ ISW(20),TITLE(20),KUNR(5),KFNR(3),DD1(3),I3,DATS(2), S0600060
     1IH,IB,IPRT(100),NLINES,KSW,NGROPS,IHOUR(1464),MUNT(4),ITABLE,IPAGES0600070
     2,ND,LINE,IPC,IUNT,JUNT,IBLNK                                      S0600080
C                                                                       S0600090
      DATA ICONT1/4H(CON,2HT)/,ICONT2/2*1H /                            S0600100
C                                                                       S0600110
      IPC = 0                                                           S0600120
      IF (IFLG1 .EQ. 0) GO TO 10                                        S0600130
      LINE = LINE+IFLG2                                                 S0600140
      IF (LINE .LE. NLINES) GO TO 80                                    S0600150
   10 IPAGE = IPAGE+1                                                   S0600160
      IF (IFLG1 .EQ. 0) GO TO 20                                        S0600170
      ICONT(1) = ICONT1(1)                                              S0600180
      ICONT(2) = ICONT1(2)                                              S0600190
      GO TO 30                                                          S0600200
   20 ICONT(1) = ICONT2(1)                                              S0600210
      ICONT(2) = ICONT2(2)                                              S0600220
      ITABLE = ITABLE+1                                                 S0600230
   30 CONTINUE                                                          S0600240
      IPC = 1                                                           S0600250
      WRITE (JUNT,9001) TITLE,DATS,ND,IPAGE,ITABLE,ICONT                S0600260
      LINE = 4+IFLG2                                                    S0600270
      GO TO (40,50,60,80),IFLG3                                         S0600280
   40 WRITE (JUNT,9002)                                                 S0600290
      GO TO 70                                                          S0600300
   50 WRITE (JUNT,9003)                                                 S0600310
      GO TO 70                                                          S0600320
   60 WRITE (JUNT,9004)                                                 S0600330
   70 LINE = LINE+2                                                     S0600340
   80 CONTINUE                                                          S0600350
      RETURN                                                            S0600360
 9001 FORMAT (1H1,15X,20A4,05X,5HDATE ,A4,A2,6H, CASE,I3,5H, PAGE,I5//60S0600370
         1X,5HTABLE,I5,1X,A4,A2/)                                       S0600380
     9002 FORMAT (54X,22H- GENERAL INPUT DATA -/)                       S0600390
     9003 FORMAT (53X,21H- SOURCE INPUT DATA -/)                        S0600400
     9004 FORMAT (50X,29H- METEOROLOGICAL INPUT DATA -/)                S0600410
          END                                                           S0600420
```

```
      SUBROUTINE ASSIGN(NREC,LREC,IER,JUNT)                             S0700000
C                                                                       S0700010
C     ROUTINE TO EXECUTE UNIVAC JCL MASS STORAGE ASSIGN (@ASG), USE     S0700020
C     (@USE) AND FREE (@FREE) COMMANDS.                                 S0700030
C                                                                       S0700040
      DIMENSION IASG(9),JASG(6),KASG(4),LASG(6)                         S0700050
C                                                                       S0700060
      EQUIVALENCE (JER,RER,X)                                           S0700070
C                                                                       S0700080
C     @ASG - ASSIGN MASS STORAGE FILE (PROGRAM NAMES FILE)              S0700090
      DATA IASG/4H@ASG,2H,T,3*1H ,4H.,F/,4H/POS,1H/,1H./                S0700100
C     @USE - EQUATE LU 12 WITH @ASG'ED FILE                             S0700110
      DATA JASG/4H@USE,4H 12.,3*1H ,3H.  ./                             S0700120
C     @FREE - RELEASE LU 12                                             S0700130
      DATA KASG/4H@FRE,3HE,C,4H12  .,1H /                               S0700140
C     @FREE - RELEASE @ASG'ED FILE                                      S0700150
      DATA LASG/4H@FRE,3HE,D,3*1H ,3H.  ./,LST/-1/                      S0700160
C                                                                       S0700170
      NREC = NREC+1                                                     S0700180
      X = FLOAT(NREC*LREC)*3.71931E-6+1.5                               S0700190
      L = X                                                             S0700200
      DO 10 I=1,2                                                       S0700210
C$$$$                                                                   S0700220
C     THIS CODING ASSUMES A 36 BIT WORD, 4 CHARACTERS PER WORD, 9 BITS  S0700230
C     PER CHARACTER.                                                    S0700240
      I1 = (31-I)*9                                                     S0700250
      I2 = MOD(I1,36)+1                                                 S0700260
      I1 = I1/36+1                                                      S0700270
      M = L/10                                                          S0700280
C     48 IS THE DECIMAL (INTEGER) EQUIVALENT IF THE CHARACTER 0         S0700290
      K = L-M*10+48                                                     S0700300
C     TAKE 9 BITS FROM K STARTING AT BIT 28 AND STORE INTO IASG(I1)     S0700310
C     STARTING AT BIT I2. THE REST OF IASG(I1) IS UNCHANGED.            S0700320
      BITS(IASG(I1),I2,9) = BITS(K,28,9)                                S0700330
C$$$$                                                                   S0700340
      L = M                                                             S0700350
   10 CONTINUE                                                          S0700360
   20 LST = LST+1                                                       S0700370
```

```
      M = (NREC+LST)*10000+LREC+LST                                     S0700380
      DO 30 I=1,12                                                      S0700390
      L = M/10                                                          S0700400
C     65 IS THE DECIMAL (INTEGER) EQUIVALENT OF THE CHARACTER A         S0700410
      K = M-L*10+65                                                     S0700420
      M = L                                                             S0700430
C$$$$                                                                   S0700440
C     THIS CODING ASSUMES A 36 BIT WORD. 4 CHARACTERS PER WORD. 9 BITS  S0700450
C     PER CHARACTER                                                     S0700460
      I1 = (7+I)*9                                                      S0700470
      I2 = MOD(I1,36)+1                                                 S0700480
      I1 = I1/36+1                                                      S0700490
C     TAKE 9 BITS FROM K STARTING AT BIT 28 AND STORE INTO IASG(I1)     S0700500
C     STARTING AT BIT IASG(I1). THE REST OF IASG(I1) IS UNCHANGED.      S0700510
      BITS(IASG(I1),I2,9) = BITS(K,28,9)                                S0700520
C$$$$                                                                   S0700530
   30 CONTINUE                                                          S0700540
      DO 40 I=3,5                                                       S0700550
      JASG(I) = IASG(I)                                                 S0700560
   40 LASG(I) = IASG(I)                                                 S0700570
C     EXECUTE UNIVAC EXECUTIVE REQUEST FUNCTION (JCL COMMAND, @FREE)    S0700580
      RER = FACSF(KASG)                                                 S0700590
C     @ASG                                                              S0700600
      RER = FACSF(IASG)                                                 S0700610
      IF (JER .GE. 0) GO TO 70                                          S0700620
C     TAKE ONE BIT FROM JER STARTING AT BIT 3 AND STORE RIGHT JUSTIFIED S0700630
C     IN I. THE REST OF I IS ZERO.                                      S0700640
      I = BITS(JER,3,1)                                                 S0700650
      IF (I .EQ. 0) GO TO 50                                            S0700660
C     EXECUTE UNIVAC EXECUTIVE REQUEST FUNCTION (JCL COMMAND, @FREE)    S0700670
      RER = FACSF(LASG)                                                 S0700680
      GO TO 20                                                          S0700690
   50 WRITE (JUNT,9001) IASG,JER                                        S0700700
   60 IER = -1                                                          S0700710
      GO TO 90                                                          S0700720
C     @USE                                                              S0700730
   70 RER = FACSF(JASG)                                                 S0700740
      IF (JER .GE. 0) GO TO 90                                          S0700750
      WRITE (JUNT,9001) JASG,JER                                      S0700760
      GO TO 60                                                        S0700770
   80 IER = JER                                                       S0700780
   90 RETURN                                                          S0700790
 9001 FORMAT (1H0,9A4/24H FAC REJECTED, STATUS = ,O12)                S0700800
      END                                                             S0700810
      SUBROUTINE ACM(CON,D,NXY)                                         S0800000
C                                                                       S0800010
      DIMENSION CON(2)                                                  S0800020
C                                                                       S0800030
C     THIS SUBROUTINE CALCULATES THE AVERAGE CONCENTRATION WHERE D IS   S0800040
C     THE INVERSE OF THE AVERAGING TIME                                 S0800050
C                                                                       S0800060
      DO 10 I=1,NXY                                                     S0800070
   10 CON(I) = CON(I)*D                                                 S0800080
      RETURN                                                            S0800090
      END                                                               S0800100
      SUBROUTINE ACCM(CON,COM,NXY)                                      S0900000
C                                                                       S0900010
      DIMENSION CON(2),COM(2)                                           S0900020
C                                                                       S0900030
C     THIS SUBROUTINE IS USED TO ACCUMULATE CONCENTRATION               S0900040
C                                                                       S0900050
      DO 10 I=1,NXY                                                     S0900060
   10 CON(I) = CON(I)+COM(I)                                            S0900070
      RETURN                                                            S0900080
      END                                                               S0900090
      SUBROUTINE ZRO(CON,NXY)                                           S1000000
C                                                                       S1000010
      DIMENSION CON(2)                                                  S1000020
C                                                                       S1000030
C     THIS SUBROUTINE IS USED TO ZERO CONCENTRATION ARRAYS              S1000040
C     THE THREE DIMENSIONAL ARRAY CON IS TREATED AS A ONE DIMENSIONAL   S1000050
C     ARRAY OF LENGTH NXPNTS*NYPNTS IN THIS SUBROUTINE AND IN ACCM AND  S1000060
C     ACM                                                               S1000070
C                                                                       S1000080
      DO 10 I=1,NXY                                                     S1000090
   10 CON(I) = 0.0                                                      S1000100
      RETURN                                                            S1000110
      END                                                               S1000120
      SUBROUTINE ERFX                                                   S1100000
C                                                                       S1100010
      COMMON /ERF/ W2,W3                                                S1100020
C                                                                       S1100030
C     THIS SUBROUTINE CALCULATES THE ERROR FUNCTIONS OF W2 AND W3 FOR   S1100040
C     THE LATERAL TERM OF THE AREA SOURCE CONCENTRATION MODEL           S1100050
C                                                                       S1100060
      DATA A/.0705230784/,B/.0422820123/,C/.0092705272/,D/.0001520143/, S1100070
     1E/.0002765672/,F/.0000430638/                                     S1100080
C                                                                       S1100090
      X = W2                                                            S1100100
      L = 1                                                             S1100110
      GO TO 20                                                          S1100120
   10 W2 = X                                                            S1100130
      X = W3                                                            S1100140
      L = 2                                                             S1100150
   20 I = 0                                                             S1100160
      IF (X) 30,70,40                                                   S1100170
   30 I = 1                                                             S1100180
      X = ABS(X)                                                        S1100190
   40 IF (X .GT. 4.7) GO TO 50                                          S1100200
      X = 1.0+X*(A+X*(B+X*(C+X*(D+X*(E+X*F)))))                         S1100210
      X = 1.0-X**(-16)                                                  S1100220
      GO TO 60                                                          S1100230
   50 X = 1.0                                                           S1100240
   60 IF (I .EQ. 1) X = -X                                              S1100250
   70 GO TO (10,80),L                                                   S1100260
   80 W3 = W2+X                                                         S1100270
      RETURN                                                            S1100280
      END                                                               S1100290
```

```
. THIS IS A UNIVAC ASSEMBLER PROCEDURE USED BY SUBROUTINE DEFFIL.
. USE THE UNIVAC PDP PROCESSOR TO ENTER THIS PROCEDURE INIO THE
. PROGRAM FILE (@PDP,IS FILENAME.IBJ,FILENAME.IBJ)
.
IBJ*         PROC        1,2
F            FORM        10,4,4,18
 DO 1-(IBJ(1)=2) ,X EQU 09
             LXI,U       IBJ(1,1),BDICALL$+IBJ(1,2)
             F           IBJ$,IBJ(1,1),0,IBJ(1,2)
             END
```

```
.  SUBROUTINE DEFFIL
.  THIS ROUTINE ALLOWS ASCII FORTRAN PROGRAMS TO DO 'DYNAMIC'
.  DEFINE FILE'S.
.  (USE THE UNIVAC MASM COMPILER TO ASSEMBLE THIS ROUTINE)
.  (ALS) THE IBJ INSTRUCTION BELOW IS AN ASSEMBLER PROCEDURE
.  (DEFINED ABOVE
.
.  CALL IS:
.
.              CALL DEFFIL (UNIT, MAX, LEN, TYPE, AV)
.
.    UNIT - INT - THE ASCII FORTRAN UNIT NUMBER.
.
.     MAX - INT - THE MAXIMUM NUMBER OF RECORDS IN THE FILE
.
.     LEN - INT - THE LENGTH OF EACH RECORD IN THE FILE.
.
.    TYPE - INT - THE FILE TYPE:
.
.                   1 - L
.                   2 - M
.                   3 - E
.                   4 - F
.                   5 - U
.                   6 - V
.
.      AV -     - THE ASSOC. VARIABLE FOR THE FILE.
.
.    JIM SCHLIGHT, UNIVERSITY OF UTAH COMPUTER CENTER, 3116 MEB,
.                   SALT LAKE CITY, UTAH  84112    (801) 581-6802
.
.
         AXR$
         ASCII
$(0)
PACKET    +        0777777,0     . 0)          777777 \ UNIT #
          +        0010000,0     . 1) 010000 + FILETYPE \ RECORD LENGTH (WORDS)
          +                0     . 2)      ADDRESS OF THE ASSOC. VARIABLE
          +                0     . 3)          MAX NUMBER OF RECORDS
                                 .                         \
RETURN    RES      1                  .

$(1)
DEFFIL*.
          SX       X11,RETURN         . SAVE OUR RETURN

          L        A1,*0,A0           . UNIT NUMBER
          S,H2     A1,PACKET          .

          L        A1,*1,A0           . MAX NUMBER OF RECORDS
          S        A1,PACKET+3        .

          L        A1,*2,A0           . RECORD-LENGTH
          SA,H2    A1,PACKET+1        .

          L        A1,*3,A0           . FILE-TYPE
          SA,S3    A1,PACKET+1        .

          L        A1,4,A0            . ADDR OF ASSOC. VARIABLE
          SA       A1,PACKET+2        .

          LXM,U    A0,PACKET          . DO THE DEFINE FILE
          IBJ      X11,F2DI$$         .

          L        X11,RETURN         .
          J        0,X11              . GO BACK
          END
```

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APPENDIX B

COMPLETE FORTRAN LISTING OF THE LONG-TERM MODEL (LONGZ) COMPUTER PROGRAM

The enclosed listing of the LONGZ program is different from the original made available to the general public in December 1979, due to coding revisions made to ease the conversion of the program to other than UNIVAC 1100 series computers. Comments have been added within the program listing for those areas that still require modification for other computers. Also, the several coding errors that have been discovered in the LONGZ program since the program was made available to the general public are corrected in the following listing.

The differences in logic between the December 1979 and March 1982 versions of LONGZ are denoted by an arrow (→) in the margin. A downward pointing arrow (↓) next to a line indicates that the changes begin at this line and continue until an upward pointing arrow (↑) is found. A horizontal arrow (→) pointing to a line indicates a change in that line only. A horizontal arrow located between two consecutive lines indicates changes in both lines or deletions. Also, it should be noted that the line numbers, statement numbers and sequence numbers in the December 1979 and March 1982 versions of LONGZ are different.

```
C                    ***** PROGRAM LONGZ *****                          S0100000
C     ***  THIS COMPUTER PROGRAM IS DESIGNED TO CALCULATED GROUND    ***S0100010
C     ***  LEVEL SEASONAL AND ANNUAL CONCENTRATION FROM UP TO        ***S0100020
C     ***  14000 SOURCES. THE REFERENCE GRID SYSTEM IS ASSUMED A     ***S0100030
C     ***  CARTESIAN COORDINATE SYSTEM WITH ORIGIN 0,0. THE PROGRAM  ***S0100040
C     ***  IS DESIGNED TO CREATE AND/OR UPDATE A MASTER SOURCE AND   ***S0100050
C     ***  CONCENTRATION INVENTORY TAPE AS WELL AS PRODUCE THE       ***S0100060
C     ***  SEASONAL AND/OR ANNUAL PRINTED CONCENTRATION FOR ANY      ***S0100070
C     ***  SOURCE OR GROUP OF SOURCES.                               ***S0100080
C     ******************************************************************S0100090
C                                                                       S0100100
C$                                                                      S0100110
C$                                                                      S0100120
C$                                                                      S0100130
C$    PARAMETER MMM CONTROLS THE AMOUNT OF CORE STORAGE AVAILABLE FOR   S0100140
C$    THE CALCULATION GRID SYSTEM, ELEVATIONS AND CONCENTRATION ARRAYS  S0100150
C$    IN BLANK COMMON ARRAY QF. BLANK COMMON SHOULD BE COLLECTED AS THE S0100160
C$    LAST ELEMENT IN THE ABSOLUTE PROGRAM.                             S0100170
C$        MMM>= 6*(NXPNTS+NYPNTS+NXWYPT)+NXPNTS+NYPNTS+2*NXWYPT         S0100180
C$             (MAX MMM = 64000)                                        S0100190
C                                                                       S0100200
      PARAMETER MMM=12000                                               S0100210
C$                                                                      S0100220
C$                                                                      S0100230
C$                                                                      S0100240
C     THE SIZE OF COMMON QF MUST BE GREATER THAN OR EQUAL TO NXPNTS*    S0100250
C     NYPNTS+NXWYPT)*6+NXPNTS+NYPNTS+2*NXWYPT. THES AREA CONTAINS THE   S0100260
C     GRID X AND Y AXES, X AND Y DISCRETE POINTS, THE CONCENTRATION     S0100270
C     ARRAYS AND THE TERRAIN HEIGHTS.                                   S0100280
C     THIS ROUTINE IS PRIMARILY USED TO SET UP THE AREA USED BY THE X   S0100290
C     AND Y ARRAYS AS WELL AS THE CONCENTRATION ARRAYS. PROGRAM RUN     S0100300
C     TIME AND CORE USAGE ARE MOST EFFICIENT WHEN THE SIZE OF COMMON QF S0100310
C     EQUALS THE ABOVE LIMITING EXPRESSION. THE ARRAYS ARE DIMENSIONED  S0100320
C     AS FOLLOWS - X(NXPNTS+NXWYPT),Y(NYPNTS+NXWYPT),CON(NXPNTS*NYPNTS+ S0100330
C     NXWYPT,5),Z(NXPNTS*NYPNTS+NXWYPT)                                 S0100340
C                                                                       S0100350
C     PROGRAM VARIABLES AND INPUTS ARE DEFINED IN THE MAIN CALCULATION  S0100360
C     SUBROUTINE MODEL.                                                 S0100370
```

```
C                                                                       S0100380
C***********************************************************************S0100390
C                                                                       S0100400
C                                                                       S0100410
C$$$$                                                                   S0100420
C     NOTE THAT ALL CODING THAT BEGINS WITH C$$$$ AND ENDS WITH C$$$$   S0100430
C     ASSUMES A 36 BIT WORD AND MUST BE MODIFIED FOR MACHINES WITH      S0100440
C     OTHER THAN 36 BITS PER INTEGER WORD.                              S0100450
C$$$$                                                                   S0100460
C                                                                       S0100470
      INTEGER TITLE,TYPE,TYPE1,TYPE2,DISP,DATS,DATE1,DATE2,TITLB        S0100480
C                                                                       S0100490
      DIMENSION TITLB(20),NSW(20),ICONST(9)                             S0100500
C                                                                       S0100510
      COMMON QF(MMM)                                                    S0100520
      COMMON /DIN/ NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTALE,NSCTOR,    S0100530
     1NXWYPT,TITLE(20),LUNT(6),LKNT(3),NSORY,ISW(20),IOVRSN,NGROUP,NSTOPS0100540
     2,NSORX                                                            S0100550
      COMMON/MET/ TK,SIGEPU(6,6),SIGEPL(6,6),G,TA(6,4),HM(6,6,4),       S0100560
     1DPDZ(6,6),PHI(16),UBAR(6),FREQ(6,16,24),P(6,6),ZR,GAMMA1,GAMMA2   S0100570
     2,ROTATE,DECAY,HA,UTMX,UTMY                                        S0100580
      COMMON /SOR/ NUMSO,TYPE,QSS(6,6,4),DX,DY,H,TS,VOL,RDS,NVS,VS(20), S0100590
     1FRQ(20),DATE1(2),HS,NBX                                           S0100600
      COMMON /SOR1/ NUMSO1,TYPE1,QSS1(6,6,4),DX1,DY1,H1,TS1,VOL1,RDS1,  S0100610
     1NVS1,VS1(20),FRQ1(20),DISP,IDMY,HS1,NBX1                          S0100620
      COMMON /SOR2/ NUMSO2,TYPE2,QSS2(6,6,4),DX2,DY2,H2,TS2,VOL2,RDS2,  S0100630
     1NVS2,VS2(20),FRQ2(20),DATE2(2),HS2,NBX2                           S0100640
      COMMON /RST/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0100650
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),NLINES   S0100660
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,DATS(2),IUNT,JUNT,IBLNK            S0100670
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0100680
C                                                                       S0100690
      EQUIVALENCE (NSW(1),XZ(1,1,1)),(NXPNTS,DUMMYN)                    S0100700
C                                                                       S0100710
      DATA ICONST/4H(MIC,4HROGR,4HAMS/,4HCUBI,4HC ME,4HTER),4H(GRA,     S0100720
     14HMS/S,4HEC) /                                                    S0100730
C                                                                       S0100740
                                                                        S0100750
```

```
C                                                                       S0100760
C        ***  START PROGRAM  ***                                        S0100770
C     RUN TITLE                                                         S0100780
      READ (IUNT,9001) TITLE                                            S0100790
C     DATA SIZE PARAMETERS                                              S0100800
      READ (IUNT,9002) NSOURC,NGROUP,NXPNTS,NYPNTS,NXWYPT,NSEASN,NSTBLE,S0100810
     1NBORX,NSPEED,NSCTOR,NSTOP,LUNT,LKNT                               S0100820
C     PROGRAM LOGIC OPTIONS                                             S0100830
      READ (IUNT,9003) (NSW(I),I=1,20),NINTP,NOTTP,NINFL,NOTFL          S0100840
      IF (NSW(10) .GT. 0) JUNT = NSW(10)                                S0100850
      IF (NINTP .EQ. 0) NINTP = 1                                       S0100860
      IF (NOTTP .EQ. 0) NOTTP = 1                                       S0100870
      IF (NINFL(1) .EQ. 0) NINFL(1) = 2                                 S0100880
      IF (NOTFL(1) .EQ. 0) NOTFL(1) = 3                                 S0100890
C     TEST FOR MASTER TAPE INPUT                                        S0100900
      IF (NSW(1) .EQ. 0) GO TO 60                                       S0100910
C     READ RECORD 1 OF INPUT MASTER TAPE                                S0100920
      DO 10 I=1,20                                                      S0100930
   10 TITLB(I) = TITLE(I)                                               S0100940
C     READ 58 WORDS FROM TAPE BUFFER INTO STORAGE STARTING AT NXPNTS    S0100950
      CALL INPOUP(-1,DUMMYN,58)                                         S0100960
      IF (NOGO .EQ. 1) WRITE (JUNT,9004)                                S0100970
      IF (NOGO .NE. 0) GO TO 110                                        S0100980
      NSW(9) = ISW(9)                                                   S0100990
      NSW(13) = ISW(13)                                                 S0101000
      NSW(14) = ISW(14)                                                 S0101010
      NSW(15) = ISW(15)                                                 S0101020
      DO 20 I=1,10                                                      S0101030
      IF (TITLB(I) .NE. IBLNK) GO TO 30                                 S0101040
   20 CONTINUE                                                          S0101050
      GO TO 50                                                          S0101060
   30 DO 40 I=1,20                                                      S0101070
   40 TITLE(I) = TITLB(I)                                               S0101080
   50 CONTINUE                                                          S0101090
   60 CONTINUE                                                          S0101100
      DO 70 I=1,20                                                      S0101110
   70 ISW(I) = NSW(I)                                                   S0101120
C     DEFAULT DATA SIZE PARAMETERS                                      S0101130
```

```
      IF (NSEASN .LE. 0) NSEASN = 1                                     S0101140
      IF (NSPEED .LE. 0) NSPEED = 6                                     S0101150
      IF (NSTBLE .LE. 0) NSTBLE = 5                                     S0101160
      IF (NSCTOR .LE. 0) NSCTOR = 16                                    S0101170
      IF (NSTOP .LE. 0) NSTOP = 999999                                  S0101180
      DO 80 I=1,4                                                       S0101190
      IF (LUNT(I) .NE. IBLNK) GO TO 90                                  S0101200
   80 CONTINUE                                                          S0101210
      LUNT(1) = ICONST(1)                                               S0101220
      LUNT(2) = ICONST(2)                                               S0101230
      LUNT(3) = ICONST(3)                                               S0101240
      LUNT(4) = ICONST(4)                                               S0101250
      LUNT(5) = ICONST(5)                                               S0101260
      LUNT(6) = ICONST(6)                                               S0101270
   90 CONTINUE                                                          S0101280
      IF (LKNT(1) .NE. IBLNK.OR.LKNT(2) .NE. IBLNK) GO TO 100           S0101290
      LKNT(1) = ICONST(7)                                               S0101300
      LKNT(2) = ICONST(8)                                               S0101310
      LKNT(3) = ICONST(9)                                               S0101320
  100 CONTINUE                                                          S0101330
                                                                        S0101340
C     QF(1) IS THE START OF THE GRID SYSTEM X AXIS                      S0101350
      J1 = NXPNTS+1                                                     S0101360
C     QF(J1) IS THE START OF THE GRID SYSTEM Y AXIS                     S0101370
      J2 = J1+NYPNTS+NXWYPT*2                                           S0101380
C     QF(J2) IS THE START OF THE CONCENTRATION ARRAYS                   S0101390
C     QF(J3) IS THE START OF THE TERRAIN HEIGHT Z ARRAY                 S0101400
      J3 = J2+(NXPNTS*NYPNTS+NXWYPT)*5                                  S0101410
      NXXYY = NXPNTS*NYPNTS+NXWYPT                                      S0101420
      CALL MODEL(QF,QF(J1),QF(J2),QF(J3),NXXYY)                         S0101430
  110 STOP                                                              S0101440
 9001 FORMAT (20A4)                                                     S0101450
 9002 FORMAT (I5,4I4,2I2,I5,2I2,I5,9A4)                                 S0101460
 9003 FORMAT (40I2)                                                     S0101470
 9004 FORMAT (27H0 END-FILE ON 1ST INPUT REC//)                         S0101480
      END                                                               S0101490
      BLOCK DATA                                                        S0200000
C                                                                       S0200010
      INTEGER TITLE,TYPE,TYPE1,TYPE2,DISP,DATS,DATE1,DATE2              S0200020
C                                                                       S0200030
      COMMON /DIM/ NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,NSCTOR,    S0200040
     1NXWYPT,TITLE(20),LUNT(6),LKNT(3),NSORY,ISW(20),IOVRSN,NGROUP,NSTOPS0200050
     2,NSORX                                                            S0200060
      COMMON/MET/ TK,SIGEPU(6,6),SIGEPL(6,6),G,TA(6,4),HM(6,6,4),       S0200070
     1DPDZ(6,6),PHI(16),UBAR(6),FREQ(6,16,24),P(6,6),ZR,GAMMA1,GAMMA2   S0200080
     2,ROTATE,DECAY,HA,UTMX,UTMY                                        S0200090
      COMMON /SOR/ NUMSO,TYPE,QSS(6,6,4),DX,DY,H,TS,VOL,RDS,NVS,VS(20), S0200100
     1FRQ(20),DATE1(2),HS,NBX                                           S0200110
      COMMON /SOR1/ NUMSO1,TYPE1,QSS1(6,6,4),DX1,DY1,H1,TS1,VOL1,RDS1,  S0200120
     1NVS1,VS1(20),FRQ1(20),DISP,IDMY,HS1,NBX1                          S0200130
      COMMON /SOR2/ NUMSO2,TYPE2,QSS2(6,6,4),DX2,DY2,H2,TS2,VOL2,RDS2,  S0200140
     1NVS2,VS2(20),FRQ2(20),DATE2(2),HS2,NBX2                           S0200150
      COMMON /RST/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0200160
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),HLINES   S0200170
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,DATS(2),IUNT,JUNT,IBLNK            S0200180
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0200190
C                                                                       S0200200
      DATA MUNT/4HMETE,2HRS,4HDEGR,3HEES/                               S0200210
C$$$$                                                                   S0200220
C     THIS CODING ASSUMES A 36 BIT WORD, 2 INTEGER VALUES PER WORD,     S0200230
C     16 BITS FOR THE LOW ORDER VALUE AND 17 BITS FOR THE UPPER ORDER   S0200240
C     VALUE.                                                            S0200250
C     MASKING AND SHIFT FACTORS USED IN SOURCE ID NUMBER VS.            S0200260
C     MASS STORAGE RECORD NUMBER RELATIONSHIP. THE ARRAY IARRY IN MODEL S0200270
C     IS USED TO STORE THE MASS STORAGE RECORD NUMBER FOR SOURCE ID     S0200280
C     NUMBER NUMSO1  EACH WORD OF IARRY CAN CONTAIN TWO RECORD NUMBERS. S0200290
C     MLT(1) IS THE SHIFT FACTOR FOR NUMSO1 = 1 TO 7000, MLT(2) IS THE  S0200300
C     SHIFT FACTOR FOR NUMSO1 = 7001 TO 14000. THE NLT VALUES ARE MASKS S0200310
C     USED TO RETRIEVE THE RECORD NUMBERS FROM IARRY.                   S0200320
      DATA MLT/1,65536,0/                                               S0200330
C     MASKS TO STORE TWO VALUES PER INTEGER WORD                        S0200340
      DATA NLT/000000177777,007777600000,0/                             S0200350
C$$$$                                                                   S0200360
      DATA NOGO,IT1REC,IT2REC,ITABLE,IPAGE/5*0/                         S0200370
      DATA IUNT,JUNT/5,6/                                               S0200380
      DATA IBLNK/1H /                                                   S0200390
C     CURRENT VERSION OF ROUTINE INPOUP + 9900                          S0200400
      DATA IOVRSN/9903/                                                 S0200410
C                                                                       S0200420
      END                                                               S0200430
      SUBROUTINE MODEL(X,Y,CON,Z,NXXYY)                                 S0300000
C     THIS SUBROUTINE IS THE MAIN CALCULATION AND PROCESSING ROUTINE FORS0300010
C     THE LONG TERM MODEL.                                              S0300020
C***********************************************************************S0300030
C                  *-* PROGRAM INPUT PARAMETERS *-*                     S0300040
C             *- MODEL AND CONTROL INPUTS -*                            S0300050
C                                                                       S0300060
C-CARD 1                                                                S0300070
C     (20A4) FORMAT                                                     S0300080
C     TITLE - 80 CHARACTERS FOR REPORT TILTE (PAGE HEADING)             S0300090
C-CARD 2                                                                S0300100
C     (I5,4I4,2I2,I5,2I2,I5,6A4,3A4)                                    S0300110
C     NSOURC - NUMBER OF INPUT SOURCES BEING READ VIA CARD (MAX = 14000)S0300120
C              (14000 IS THE MAXIMUM NUMBER OF SOURCES AND IS ALSO      S0300130
C               THE MAXIMUM VALUE A SOURCE NUMBER CAN TAKE              S0300140
C     NGROUP - NUMBER OF DIFFERENT SOURCE COMBINATIONS FOR REPORTS OF   S0300150
C              SEASONAL AND/OR ANNUAL CONCENTRATION PATTERNS (MAX=1000) S0300160
C     NXPNTS - NUMBER OF POINTS ON THE X COORDINATE AXIS OF THE         S0300170
C              REFERENCE GRID SYSTEM (MAXIMUM = 100)                    S0300180
C     NYPNTS - NUMBER OF POINTS ON THE Y COORDINATE AXIS OF THE         S0300190
C              REFERENCE GRID SYSTEM (MAXIMUM = 100)                    S0300200
C     NXWYPT - NUMBER OF DISCRETE OR SPECIAL (X,Y) CALCULATION POINTS   S0300210
C     NSEASN - NUMBER OF SEASONS IN THE INPUT METEOROLOGICAL DATA       S0300220
C              (IF BLANK OR ZERO PROG. ASSUMES 1 OR ANNUAL ONLY) (MAX=4)S0300230
C     NSTBLE - NUMBER OF PASQUILL STABILITY CATEGORIES OR TIME OF DAY   S0300240
C              CATEGORIES. (MAXIMUM = 6)                                S0300250
C              (IF BLANK OR ZERO THE PROGRAM ASSUMES 5 PASQUILL         S0300260
C              CATEGORIES)                                              S0300270
C     NSORX - THIS PARAMETER GIVES THE TOTAL NUMBER OF NON-DELETED      S0300280
C             SOURCES IN THE OUTPUT TAPE INVENTORY AT THE COMPLETION    S0300290
C             OF THIS RUN. IF EQUAL TO 0 THE PROG USES NSOURC OR        S0300300
C             NSOURC PLUS THE NUMBER ON THE INPUT TAPE. THIS PARAMETER  S0300310
C             MUST BE INPUT IF BOTH INPUT AND OUTPUT TAPES ARE USED AND S0300320
C             NSOURC IS > 0, UNLESS THE NSOURC SOURCES ARE ONLY         S0300330
C             ADDITIONS TO THE INVENTORY.                               S0300340
C     NSPEED - NUMBER OF WIND SPEED CATEGORIES                          S0300350
C              (IF BLANK OR ZERO PROGRAM ASSUMES 6) (MAXIMUM=6)         S0300360
C     NSCTOR - NUMBER OF WIND DIRECTION CATEGORIES                      S0300370
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      C              (IF BLANK OR ZERO THE PROGRAM ASSUMES 16 FOR THE STANDARDS0300380
      C              16 POINTS OF THE COMPASS) (MAXIMUM = 16)                 S0300390
      C     NSTOP - SOURCE NUMBER OF LAST SOURCE ON INPUT TAPE TO BE          S0300400
      C             COPIED TO OUTPUT TAPE. IF ALL SOURCES ARE TO BE           S0300410
      C             COPIED INPUT NSTOP AS ZERO OR BLANK.                      S0300420
      C     LUNT - 24 CHARACTERS TO IDENTIFY CONCENTRATION OUTPUT UNITS. IF   S0300430
      C            BLANKS THE PROG USES (MICROGRAMS/CUBIC METER).             S0300440
      C     LKNT - 12 CHARACTERS TO IDENTIFY THE INPUT SOURCE STRENGTH UNITS. S0300450
      C            IF BLANKS THE PROGRAM USES (GRAMS/SEC).                    S0300460
      C-CARD 3                                                                S0300470
      C     (20I2,8I2) FORMAT                                                 S0300480
      C     ISW - PROGRAM LOGIC OPTIONS                                       S0300490
      C        ISW(1) - IF SET TO 1 MASTER SOURCE-CONCENTRATION INVENTORY     S0300500
      C                  TAPE INPUT IS ASSUMED ON TAPE UNIT NINFL.            S0300510
      C                 DATA CARD GROUP 6 THROUGH 17 ARE NOT READ. THIS       S0300520
      C                 INFORMATION IS TAKEN FROM TAPE, ALSO THE PARAMETERS   S0300530
      C                 NXPNTS THROUGH NSCTOR ON CARD 2 ARE TAKEN FROM        S0300540
      C                 TAPE. IF SET TO 2 THE PROGRAM ASSUMES THAT NEW MET    S0300550
      C                 INPUTS ARE REQUIRED FOR THE SOURCE CALCULATIONS IN    S0300560
      C                 THIS RUN AND READS ALL CARD GROUPS EXCEPT 6 AND 7.    S0300570
      C                 THE NEW MET DATA MUST HAVE THE SAME NUMBER OF         S0300580
      C                 SPEED, STABILITY, SEASONS, DIRECTION CATEGORIES AS    S0300590
      C                 THE OLD MET DATA.                                     S0300600
      C                 IF SET TO 0 NO TAPE INPUT IS ASSUMED.                 S0300610
      C        ISW(2) - IF SET TO 1 MASTER SOURCE-CONCENTRATION INVENTORY     S0300620
      C                  TAPE OUTPUT IS ASSUMED ON TAPE UNIT NOTFL.           S0300630
      C                 IF SET TO 2 A SOURCE INVENTORY LISTING IS PRODUCED    S0300640
      C                 AS WELL AS MASTER TAPE OUTPUT.                        S0300650
      C                 IF SET TO 0 NO TAPE OUTPUT AND NO SOURCE INVENTORY    S0300660
      C                 LISTING ARE ASSUMED.                                  S0300670
      C        ISW(3) - IF SET TO 1 PRODUCE REPORTS ON A SEASONAL BASIS       S0300680
      C                 IF SET TO 0 IGNORE SEASONAL CONCENTRATION             S0300690
      C        ISW(4) - IF SET TO 1 PRODUCE REPORTS ON AN ANNUAL BASIS        S0300700
      C                 IF SET TO 0 ANNUAL CONCENTRATION IS IGNORED           S0300710
      C               (IF BOTH ISW(3) AND ISW(4) ARE ZERO THEN ISW(4) IS      S0300720
      C                DEFAULTED TO 1)                                        S0300730
      C        ISW(5) - IF SET TO 1 LIST PROGRAM MODEL AND CONTROL            S0300740
      C                 PARAMETERS EXCEPT FOR SOURCE INPUTS                   S0300750
      C          ISW(6) - IF SET TO 1 LIST INPUT CARD SOURCES                    S0300760
      C          ISW(7) - IF SET TO 1 LIST INPUT TAPE SOURCES                    S0300770
      C          ISW(8) - IF SET TO 1 THE PROG ASSUMES TERRAIN HEIGHTS Z ARE     S0300780
      C                   READ                                                   S0300790
      C                   IF SET TO 0 TERRAIN HEIGHTS Z (CARD GROUP 7A ARE       S0300800
      C                   NOT READ)                                              S0300810
      C          ISW(9) - IF SET TO ZERO THE WIND SPEED POWER LAW IS BASED       S0300820
      C                   ON ELEVATION ABOVE AIRPORT ELEVATION. IF THE HEIGHT    S0300830
      C                   IS BELOW NO POWER LAW IS USED.                         S0300840
      C                   IF SET NON-ZERO THE WIND SPEED POWER LAW IS BASED      S0300850
      C                   ON HEIGHT ABOVE TERRAIN AND A POWER LAW IS ALWAYS      S0300860
      C                   USED. IF THE HEIGHT OF A BUILDING OR AREA SOURCE       S0300870
      C                   IS LESS THAN HMIN METERS DEFINED BELOW, HMIN           S0300880
      C                   METERS IS USED                                         S0300890
      C          ISW(10) - IF SET TO ZERO ALL PRINTOUT IS SENT TO THE            S0300900
      C                    PRINTER, LOGICAL UNIT 6.  IF SET GREATER THAN ZERO    S0300910
      C                    PRINTOUT IS SENT TO THE LOGICAL UNIT SPECIFIED        S0300920
      C                    BY THE VALUE OF ISW(10).  EXCEPT FOR LOGICAL UNIT     S0300930
      C                    6 THE PROGRAM ASSUMES THAT A FILE HAS BEEN            S0300940
      C                    ASSOCIATED WITH THE LOGICAL UNIT NUMBER.              S0300950
      C                    2 END-OF-FILE MARKS ARE WRITTEN ON THE LOGICAL        S0300960
      C                    UNIT AND THE TAPE IS REWOUND.                         S0300970
      C          ISW(11) - IF GREATER THAN ZERO THE PROGRAM IS TO READ THE       S0300980
      C                    FORMAT FOR CARD GROUP 9A INTO FMT IN CARD GROUP       S0300990
      C                    9. (SEE CARD GROUP 8 AND 8A)                          S0301000
      C          ISW(12) - IF GREATER THAN ZERO THE PROGRAM IS TO READ THE       S0301010
      C                    FORMAT FOR CARD GROUP 18A INTO SFMT IN CARD GROUP     S0301020
      C                    18. (SEE CARD GROUPS 19 AND 18A)                      S0301030
      C          ISW(13) - IF = 0 THE GRID SYSTEM POINTS ARE IN CARTESIAN        S0301040
      C                           COORDINATES.                                   S0301050
      C                    IF = 1 THE GRID SYSTEM POINTS ARE IN POLAR            S0301060
      C                           COORDINATES WHERE X IS RANGE AND Y IS AZIMUTHS0301070
      C                           BEARING CLOCKWISE FROM 0 DEGREES NORTH.        S0301080
      C          ISW(14) - IF = 0 THE NXWYPT DISCRETE POINTS ARE IN CARTESIAN    S0301090
      C                           COORDINATES.                                   S0301100
      C                    IF = 1 THE DISCRETE POINTS ARE IN POLAR COORDINATES S0301110
      C          ISW(15) - IF = 0 THE SOURCES COORDINATES ARE IN CARTESIAN       S0301120
      C                           COORDINATES.                                   S0301130
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C                       IF = 1 THE SOURCES COORDINATES ARE IN POLAR          S0301140
C                              COORDINATES.                                  S0301150
C            ISW(16) - IF = 0 CARD GROUP 13 - SIGEPU CONTAINS THE STANDARD S0301160
C                              DEVIATION OF THE WIND ELEVATION ANGLE FOR     S0301170
C                              STACK, BUILDING AND AREA SOURCES. DEFAULT     S0301180
C                              VALUES FOR SIGEPU ARE PROVIDED DEPENDING ON   S0301190
C                              THE STABILITY CATEGORY AND WHETHER THE PROG.  S0301200
C                              IS RUN IN THE RURAL OR URBAN MODE. ALSO,      S0301210
C                              CARD GROUP 14 IS NOT READ IF ISW(16) = 0.     S0301220
C                       IF = 1 CARD GROUP 13 - SIGEPU CONTAINS THE STANDARD S0301230
C                              DEVIATION OF THE WIND ELEVATION ANGLE FOR     S0301240
C                              STACK TYPE SOURCES ONLY AND CARD GROUP 14 -   S0301250
C                              SIGEPL CONTAINS THOSE FOR BUILDING AND AREA   S0301260
C                              SOURCES. BOTH CARD GROUPS 13 AND 14 ARE READ S0301270
C                              BY THE PROGRAM. NO DEFAULT VALUES ARE         S0301280
C                              PROVIDED FOR SIGEPU OR SIGEPL IF ISW(16) = 1.S0301290
C            ISW(17) - RURAL/URBAN MODE OPTION. THIS OPTION IS IGNORED       S0301300
C                      IF ISW(16) = 1. IF ISW(16) = 0 THIS OPTION CONTROLS S0301310
C                      THE DEFAULT SIGEPU VALUES FOR CARD GROUP 13.          S0301320
C                        IF = 0 RURAL MODE                                   S0301330
C                        IF = 1 URBAN MODE                                   S0301340
C                      THE PROGRAM USES THE FOLLOWING DEFAULT VALUES,        S0301350
C                      DEPENDING ON STABILITY, FOR SIGEPU, IF ANY VALUE      S0301360
C                      IS NOT PUNCHED OR IS ZERO.                            S0301370
C                                             - STABILITY -                  S0301380
C                                     A     B     C     D     E     F        S0301390
C                          MODE            - DEFAULT SIGEPU -                S0301400
C                      RURAL MODE .1745 .1080 .0735 .0465 .0350 .0235        S0301410
C                      URBAN MODE .1745 .1745 .1080 .0735 .0465 .0465        S0301420
C            ISW(18) - ISW(20) - N/A                                         S0301430
C        NINTP - NO. OF INPUT TAPES                                          S0301440
C        NOTTP - NO. OF OUTPUT TAPES                                         S0301450
C        NINFL - ARRAY OF UP TO 3 LOGICAL INPUT TAPE NUMBERS. (DEFAULT IS  S0301460
C                NINFL(1)=2, ALL 3 VALUES ARE READ)                          S0301470
C        NOTFL - ARRAY OF UP TO 3 LOGICAL OUTPUT TAPE NUMBERS. (DEFAULT IS S0301480
C                NOTFL(1)=3, ALL 3 VALUES ARE READ)                          S0301490
C-CARD GROUP 4 ( CARD GROUPS 4 AND 5 ARE NOT READ IF NGROUP = 0)            S0301500
C        (20I4) FORMAT                                                       S0301510
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C      NSOGRP - ARRAY CONTAINING THE NUMBER OF SOURCE NUMBERS IN EACH OF S0301520
C                THE NGROUP CONCENTRATION REPORTS (MAX OF 1000 VALUES)    S0301530
C-CARD GROUP 5 (NOT READ IF NGROUP = 0)                                   S0301540
C      (13I6) FORMAT                                                      S0301550
C      IDSOR - ARRAY CONTAINING THE GROUPS OF SOURCE NUMBERS THAT ARE TO S0301560
C              BE USED IN CONCENTRATION REPORTS (MAXIMUM OF 1000 VALUES) S0301570
C              (EXAMPLE - ASSUME NGROUP EQUALS 4 AND NSOGRP(1)=5,      )  S0301580
C              (NSOGRP(2)=2,NSOGRP(3)=1 AND NSOGRP(4)=2 . ALSO ASSUME )  S0301590
C              (THE SOURCE NUMBER ARRAY IDSOR CONTAINS THE FOLLOWING  )  S0301600
C              (STRING OF NUMBERS 8,32,-39,52,70,100,-105,107,37,-49  )  S0301610
C              (THE FIRST CONCENTRATION REPORT WILL CONSIST OF THE    )  S0301620
C              (SUM OF SOURCES 8, 32 THROUGH 39, 52 AND 70            )  S0301630
C              (THE SECOND CONCENTRATION REPORT WILL CONSIST OF THE   )  S0301640
C              (SUM OF SOURCES 100 THROUGH 105                        )  S0301650
C              (THE THIRD, SOURCE 107 ONLY                            )  S0301660
C              (THE FOURTH, THE SUM OF SOURCES 37 THROUGH 49          )  S0301670
C CARD GROUPS 6 THROUGH 7 ARE NOT READ IF ISW(1) IS GREATER THAN 0.      S0301680
C-CARD GROUP 6 (THIS CARD GROUP IS NOT READ IF NXPNTS=0)                 S0301690
C      (8F10.0) FORMAT                                                    S0301700
C      X - X AXIS OF THE REFERENCE GRID SYSTEM. THE POSITIVE X AXIS      S0301710
C          IS AT 90 DEGREES (EAST) (METERS)                               S0301720
C          IF ISW(13) IS SET FOR POLAR COORDINATES THEN X IS THE RANGE   S0301730
C          IN METERS. ALSO, IF ONLY TWO VALUES OF X ARE INPUT AND NXPNTS S0301740
C          IS GREATER THAN 2 THE PROGRAM ASSUMES THE FIRST VALUE IS THE  S0301750
C          START OF THE AXIS AND THE SECOND IS AN INCREMENT TO USE TO    S0301760
C          GENERATE THE SECOND THROUGH NXPNTS POINTS.                    S0301770
C-CARD GROUP 6A (THIS CARD GROUP IS NOT READ IF NXWYPT = 0)               S0301780
C      (8F10.0) FORMAT                                                    S0301790
C      X - DISCRETE X POINTS IF NXWYPT IS > 0. (METERS)                  S0301800
C          IF ISW(14) IS SET FOR POLAR COORDINATES THEN X IS THE RANGE.  S0301810
C-CARD GROUP 7 (THIS CARD GROUP IS NOT READ IF NYPNTS=0)                 S0301820
C      (8F10.0) FORMAT                                                    S0301830
C      Y - Y AXIS OF THE REFERENCE GRID SYSTEM. THE POSITIVE Y AXIS      S0301840
C          IS AT 0 DEGREES (NORTH) (METERS)                               S0301850
C          IF ISW(13) IS SET FOR POLAR COORDINATES THEN Y IS THE AZIMUTH S0301860
C          BEARING FROM THE THE ORIGIN TO THE RECEPTOR POINT MEASURED    S0301870
C          CLOCKWISE FROM 0 DEGREES NORTH. ALSO, IF ONLY TWO VALUES OF Y S0301880
C          ARE INPUT AND NYPNTS IS GREATER THAN 2 THE PROGRAM ASSUMES THES0301890
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C         FIRST VALUE IS THE START OF THE AXIS (AZIMUTH) AND THE SECOND S0301900
C         IS AN INCREMENT TO USE TO GENERATE THE SECOND THROUGH NYPNTS  S0301910
C         POINTS.                                                       S0301920
C-CARD GROUP 7A (THIS CARD GROUP IS NOT READ IF NXWYPT = 0)              S0301930
C     (8F10.0) FORMAT                                                   S0301940
C     Y - DISCRETE Y POINTS IF NXWYPT IS > 0. (METERS)                  S0301950
C         IF ISW(14) IS SET FOR POLAR COORDINATES THEN Y IS THE AZIMUTH S0301960
C         BEARING.                                                      S0301970
C-CARD GROUP 7B (THIS CARD GROUP IS NOT READ IF ISW(8)=0, OR IF         S0301980
C                NXPNTS=NYPNTS=0 OR IF ISW(1)=1 OR 2)                   S0301990
C     (8F10.0) FORMAT                                                   S0302000
C     Z - TERRAIN ELEVATION HEIGHTS FOR EACH GRID COORDINATE            S0302010
C         (Z(I,J)) (METERS)                                             S0302020
C         STARTING WITH THE FIRST Y POINT PUNCH THE Z'S FOR EACH X      S0302030
C         POINT, 1 TO NXPNTS. START A NEW DATA CARD FOR EACH SUBSEQUENT S0302040
C         Y POINT.                                                      S0302050
C-CARD GROUP 7C (THIS CARD GROUP IS NOT READ IF ISW(8)=0 OR NXWYPT=0 OR S0302060
C                ISW(1) = 1 OR 2)                                       S0302070
C     (8F10.0) FORMAT                                                   S0302080
C     Z - TERRAIN ELEVATIONS IN METERS FOR THE DISCRETE POINTS          S0302090
C CARD GROUPS 8 THROUGH 17 ARE NOT READ IF ISW(1)=1, BUT ARE READ IF    S0302100
C ISW(1)=2.                                                             S0302110
C-CARD GROUP 8 (READ ONLY IF ISW(11) IS GREATER THAN ZERO)              S0302120
C     (20A4) FORMAT                                                     S0302130
C     FMT - FORMAT THE PROGRAM IS TO USE TO READ CARD GROUP 8A. IF NOT  S0302140
C           INPUT (ISW(11)=0) THE PROGRAM USES 6F10.0 FOR CARD GROUP 8A S0302150
C           FORMAT. IF PUNCHED INCLUDE LEADING AND ENDING PARENTHESIS.  S0302160
C-CARD GROUP 8A                                                         S0302170
C     (FORMAT IS FMT ABOVE)                                             S0302180
C     FREQ - FREQUENCY OF OCCURRENCE OF WIND SPEED AND DIRECTION FOR    S0302190
C            EACH WIND SPEED CATEGORY WITHIN EACH DIRECTION CATEGORY    S0302200
C            WITHIN EACH STABILITY CATEGORY WITHIN EACH SEASON (THE     S0302210
C            SUM OF THE FREQ VALUES OVER 1 SEASON IS 1.0)               S0302220
C            BEGINNING WITH SEASON 1 PUNCH THE VALUES FOR EACH SPEED    S0302230
C            CATEGORY ACROSS THE CARD (MAX = 6 VALUES) FOR EACH WIND    S0302240
C            DIRECTION CATEGORY (N, NNE,...,NNW) FOR STABILITY CATEGORY S0302250
C            1 (A). REPEAT FOR EACH STABILITY CATEGORY THEN START WITH  S0302260
C            THE NEXT SEASON.                                           S0302270
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C-CARD GROUP 9                                                          S0302280
C       (9F10.0) FORMAT                                                 S0302290
C       TA - AMBIENT AIR TEMPERATURE FOR EACH STABILITY CATEGORY FOR EACH S0302300
C            SEASON (DEGREES KELVIN)                                    S0302310
C            VALUES FOR EACH STABILITY CATEGORY ARE PUNCHED ACROSS THE   S0302320
C            CARD. IF ANY VALUE IS ZERO (BLANK) IT IS DEFAULTED TO THE   S0302330
C            LAST NON-ZERO VALUE READ.                                  S0302340
C            NSEASN CARDS ARE READ.                                     S0302350
C-CARD GROUP 10                                                         S0302360
C       (9F10.0) FORMAT                                                 S0302370
C       HM - MIXING LAYER HEIGHT ABOVE GROUND FOR EACH WIND SPEED CATEGORYS0302380
C            WITHIN EACH STABILITY CATEGORY WITHIN EACH SEASON. (METERS)  S0302390
C            VALUES FOR EACH SPEED CATEGORY ARE PUNCHED ACROSS THE CARD.  S0302400
C            IF ANY VALUE IS ZERO (BLANK) IT IS DEFAULTED TO THE LAST     S0302410
C            NON-ZERO VALUE READ.                                       S0302420
C            THERE ARE NSTBLE CARDS, 1 TO NSTBLE, FOR EACH SEASON        S0302430
C-CARD GROUP 11                                                         S0302440
C       (9F10.0) FORMAT                                                 S0302450
C       DPDZ - VERTICAL GRADIENT OF POTENTIAL TEMPERATURE FOR EACH WIND   S0302460
C              SPEED CATEGORY WITHIN EACH STABILITY CATEGORY (DEGREES     S0302470
C              KELVIN/METER)                                            S0302480
C              VALUES FOR EACH SPEED CATEGORY ARE PUNCHED ACROSS THE CARD.S0302490
C              THERE ARE NSTBLE CARDS READ.                             S0302500
C              THERE ARE NO DEFAULTS FOR DPDZ. A VALUE LESS THAN OR EQUAL S0302510
C              TO ZERO INDICATES PLUME RISE FOR UNSTABLE CONDITIONS IS TO S0302520
C              BE USED AND A VALUE GREATER THAN ZERO INDICATES STABLE     S0302530
C              CONDITIONS.                                              S0302540
C-CARD GROUP 12                                                         S0302550
C       (F7.0,F10.0,5F7.0,2F5.0,F11.0) FORMAT                           S0302560
C       ROTATE - THIS PARAMETER IS USED TO CORRECT FOR ANY DIFFERENCE IN  S0302570
C                NORTH AS DEFINED BY THE X,Y GRID SYSTEM AND NORTH AS     S0302580
C                DEFINED BY THE WEATHER STATION AT WHICH THE WIND         S0302590
C                DIRECTION DATA WAS RECORDED. THE VALUE OF ROTATE IS      S0302600
C                SUBTRACTED FROM EACH WIND DIRECTION CATEGORY. ROTATE IS  S0302610
C                POSITIVE IF THE POSITIVE Y AXIS OF THE GRID SYSTEM POINTSS0302620
C                TO THE RIGHT OF NORTH AS DEFINED BY THE WEATHER STATION  S0302630
C                AND NEGATIVE WHEN THE POSITIVE Y AXIS OF THE GRID SYSTEM S0302640
C                POINTS TO THE LEFT.                                    S0302650
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C             THE PROGRAM ASSUMES THAT THE METEOROLOGICAL DATA     S0302660
C          (WIND DIRECTION) RECORDED AT THE WEATHER STATION IS     S0302670
C          APPLICABLE AT THE SOURCE LOCATION. MOST WEATHER STATIONS S0302680
C          RECORD DIRECTION RELATIVE TO TRUE NORTH AND MOST GRID   S0302690
C          SYSTEMS ARE RELATIVE TO TRUE NORTH. HOWEVER, SOME WEATHERS0302700
C          STATIONS RECORD DIRECTION RELATIVE TO MAGNETIC NORTH.   S0302710
C          ALSO, UTM (UNIVERSAL TRANSVERSE MERCATOR) COORDINATES   S0302720
C          ARE ORIENTED RELATIVE TO TRUE NORTH AT THE CENTER OF THE S0302730
C          UTM ZONE, BUT HAVE AN INCREASING POS. OR NEG. DECLINATIONSS0302740
C          ANGLE AS YOU APPROACH THE ENDS OF THE UTM ZONE.         S0302750
C     TK - MODEL UNITS CONVERSION FACTOR - USED TO CHANGE SOURCE INPUT  S0302760
C          UNITS TO DESIRED OUTPUT CONCENTRATION UNITS (IF BLANK OR ZEROS0302770
C          PROGRAM ASSUMES Q1 IS IN GRAMS/SEC AND SETS TK=1.0E6 ASSUMINGS0302780
C          CONCENTRATION IN MICROGRAMS/CUBIC METER IF ALL PROGRAM UNIT  S0302790
C          CONVENTIONS ARE FOLLOWED)                               S0302800
C     HA - ELEVATION OF AIRPORT OR WEATHER STATION (METERS)        S0302810
C     UTMX - OPTIONAL X COORDINATE OF ORIGIN OF POLAR COORDINATES  S0302820
C            IN CARTESIAN (UTM) SYSTEM (METERS) (DEFAULT=0.0).     S0302830
C            IF INPUT ALL POLAR COORDINATES ARE RELATIVE TO UTMX,UTMY.  S0302840
C     UTMY - OPTIONAL Y COORDINATE OF ORIGIN OF POLAR COORDINATES  S0302850
C            IN CARTESIAN (UTM) SYSTEM (METERS) (DEFAULT=0.0)      S0302860
C            IF INPUT ALL POLAR COORDINATES ARE RELATIVE TO UTMX, UTMY. S0302870
C            (IF THE DISCRETE RECEPTORS ARE INPUT IN POLAR COORDINATES  S0302880
C             AND UTMX OR UTMY IS PUNCHED NON-ZERO THE PROGRAM CONVERTS S0302890
C             THE DISCRETE RECEPTORS TO CARTESIAN (UTM) COORDINATES FOR S0302900
C             THE CONCENTRATION PRINTED OUTPUT TABLES)             S0302910
C     G - ACCELERATION OF GRAVITY (IF BLANK OR ZERO PROGRAM ASSUMES     S0302920
C         9.8 METERS/SEC**2)                                       S0302930
C     ZR - HEIGHT ABOVE GROUND AT WHICH WIND SPEED IS MEASURED (METERS) S0302940
C          (IF BLANK OR ZERO PROG ASSUMES 6.096 METERS OR 20 FT)   S0302950
C     GAMMA1 - AIR ENTRAINMENT COEFFICIENT FOR AN ADIABATIC UNSTABLE    S0302960
C              ATMOSPHERE (IF BLANK OR ZERO THE PROGRAM USES 0.6)  S0302970
C     GAMMA2 - AIR ENTRAINMENT COEFFICIENT FOR A STABLE ATMOSPHERE S0302980
C              (IF BLANK OR ZERO THE PROGRAM ASSUMES 0.66)         S0302990
C     DECAY - DECAY COEFFICIENT FOR POLLUTANT REMOVAL BY PHYSICAL OR    S0303000
C             CHEMICAL PROCESSES (IF BLANK OR ZERO DECAY IS IGNORED)    S0303010
C             THE UNITS OF DECAY ARE SEC**-1, WHERE THE CONCENTRATION   S0303020
C             IS MULTIPLIED BY EXP(-DECAY*T) AND T IS TIME FROM THE     S0303030
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C             SOURCE TO RECEPTOR POINT. FOR EXAMPLE IF THE HALF-LIFE   S0303040
C             OF A POLLUTANT IS 3 HOURS (10800 SEC.) THEN DECAY IS      S0303050
C             CALCULATED BY                                             S0303060
C                      DECAY = ABS(LN(.5))/10800 = APPROX. 0.00006418   S0303070
C             WHERE LN IS THE NATURAL LOG.                              S0303080
C-CARD GROUP 13                                                         S0303090
C     (8F10.0) FORMAT                                                   S0303100
C     SIGEPU - STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR       S0303110
C                A - ALL SOURCES IF ISW(16) = 0.                        S0303120
C                B - STACK SOURCES (TYPE1 = 0) ONLY IF ISW(16) = 1.     S0303130
C              SIGEPU DEPENDS ON WIND SPEED AND STABILITY, INPUT NSPEED S0303140
C              VALUES PER CARD AND NSTBLE CARDS.                        S0303150
C              IF ISW(16) = 0 DEFAULT VALUES DEPEND ON STABILITY AND    S0303160
C              RURAL OR URBAN MODE AND ARE GIVEN UNDER ISW(17) ABOVE.   S0303170
C              IF ISW(16) = 1 NO DEFAULT VALUES ARE PROVIDED.           S0303180
C              IF SIGEPU IS GREATER THAN OR EQUAL TO 1.0 THE PROGRAM    S0303190
C              ASSUMES THE VALUE IS IN DEGREES, IF LESS THAN 1.0 THE    S0303200
C              PROGRAM ASSUMES RADIANS.                                 S0303210
C-CARD GROUP 14 (NOT READ IF ISW(16) = 0)                               S0303220
C     (9F10.0)                                                          S0303230
C     SIGEPL - STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR       S0303240
C              BUILDING (TYPE1 = 1) AND AREA (TYPE1 = 2) SOURCES.       S0303250
C              SIGEPL DEPENDS ON WIND SPEED AND STABILITY, INPUT NSPEED S0303260
C              VALUES PER CARD AND NSTBLE CARDS. NO DEFAULT VALUES ARE  S0303270
C              PROVIDED FOR SIGEPL. IF SIGEPL IS GREATER THAN OR EQUAL  S0303280
C              TO 1.0 THE PROGRAM ASSUMES THE VALUE IS IN DEGREES, IF   S0303290
C              LESS THAN 1.0 THE PROGRAM ASSUMES RADIANS.               S0303300
C-CARD GROUP 15                                                         S0303310
C     (9F10.0) FORMAT                                                   S0303320
C     UBAR - WIND SPEED CATEGORIES (IF BLANK OR ZERO THE PROGRAM ASSUMESS0303330
C           .75,2.5,4.3,6.8,9.5,12.5 METERS/SEC)                        S0303340
C            THESE ARE THE MEDIAN VALUE OF EACH WIND SPEED CATEGORY     S0303350
C-CARD GROUP 16                                                         S0303360
C     (9F10.0) FORMAT                                                   S0303370
C     P - WIND SPEED POWER LAW EXPONENT FOR EACH WIND SPEED CATEGORY    S0303380
C         WITHIN EACH STABILITY CATEGORY (IF BLANK OR ZERO THE PROGRAM  S0303390
C         ASSUMES -            - SPEED CATEGORIES 1 TO 6 -              S0303400
C         STABILITY 1=A    .10 , .10 , .10 , .10 , .10 , .10            S0303410
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C                     2=B    .15 , .10 , .10 , .10 , .10 , .10              S0303420
C                     3=C    .20 , .15 , .10 , .10 , .10 , .10              S0303430
C                     4=D    .25 , .20 , .15 , .10 , .10 , .10              S0303440
C                     5=E    .30 , .25 , .20 , .15 , .10 , .10              S0303450
C                     6=F    .40 , .30 , .20 , .15 , .10 , .10              S0303460
C           INPUT NSPEED VALUES PER CARD AND NSTBLE CARDS                   S0303470
C-CARD GROUP 17                                                             S0303480
C      (9F10.0) FORMAT                                                      S0303490
C      THETA - WIND DIRECTION SECTOR ANGLE CATEGORIES. DIRECTION FROM       S0303500
C             WHICH THE WIND IS COMING. THETA IS ALSO REFERED TO AS         S0303510
C             PHI IN MOST OF THE PROGRAM (IF BLANK OR ZERO'S THE            S0303520
C             PROGRAM ASSUMES   0,22.5,45,67.5,90,112.5,135,157.5,180,      S0303530
C             202.5,225,247.5,270.0,292.5,315,337.5 DEGREES FOR THE         S0303540
C             SECTORS N,NNE,NE,ENE,E,...,NW,NNW)                            S0303550
C             NOTE - IF NSCTOR ABOVE IS DEFAULTED TO 16 OR > 8 IN VALUE     S0303560
C             2 CARDS ARE REQUIRED FOR PHI, 8 VALUES PER CARD.              S0303570
C                                                                           S0303580
C         *- SOURCE INPUTS -*                                               S0303590
C                                                                           S0303600
C-CARD GROUP 18 (NOT READ IF ISW(12) = 0)                                   S0303610
C      (20A4) FORMAT                                                        S0303620
C      SFMT - FORMAT FOR CARD GROUP 18A INCLUDING LEADING AND ENDING        S0303630
C              PARENTHESIS. IF ISW(12) = 0 THE DEFAULT FORMAT IS -          S0303640
C              (I5,2I1,6F7.0,4F6.0,F5.0,I2)                                 S0303650
C-CARD GROUP 18A                                                            S0303660
C      (SEE SFMT ABOVE FOR FORMAT)                                          S0303670
C      NUMS01- SOURCE IDENTIFICATION NUMBER (FROM 1 TO 20000) (SOURCES      S0303680
C               ARE INPUT IN ASCENDING ORDER ACCORDING TO NUMS01 BUT NOT    S0303690
C               NECESSARILY CONTINUOUS, I.E. 1,2,10,100,101,103,ETC. IS     S0303700
C               OK)                                                         S0303710
C      TYPE1 - SOURCE TYPE                                                  S0303720
C                    -IF 0 THE SOURCE IS AN ELEVATED POINT SOURCE (STACK)   S0303730
C                    -IF 1 THE SOURCE IS A LOW-LEVEL EMISSION (VOLUME)      S0303740
C                    -IF 2 THE SOURCE IS AN AREA-SOURCE                     S0303750
C      DISP - SOURCE INPUT DISPOSITION (INTEGER)                            S0303760
C                    -IF 0 USE SOURCE PARAMETERS ON THIS CARD TO CALCULATE S0303770
C                     CONCENTRATION AND INSERT IN SOURCE INVENTORY OR       S0303780
C                     REPLACE THE CURRENT SOURCE NUMS01                     S0303790
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C                -IF 1 USE SOURCE STRENGTH(S) ON THIS CARD TO RESCALE  S0303800
C                 OR RECALCULATE CONCENTRATIONS FOR SOURCE NUMSQ1. IF  S0303810
C                 OLD Q1 IS 0 CONCENTRATION IS CALCULATED. IF OLD Q1   S0303820
C                 IS GREATER THAN ZERO THE CONCENTRATION IS MULTIPLIED S0303830
C                 BY THE RATIO OF THE NEW OVER THE OLD Q1 VALUE.       S0303840
C                -IF 2 THEN DELETE SOURCE NUMSQ1 FROM THE SOURCE       S0303850
C                 INVENTORY                                            S0303860
C                -IF 3 THEN DO NOT USE Q1 ON THIS CARD, BUT READ SOURCES0303870
C                 STRENGTHS FROM CARD GROUP 18B BELOW. IF DISP IS SET  S0303880
C                 TO 3 THE ACTION IS THE SAME AS IF SET TO 0. THERE IS S0303890
C                 NO EQUIVALENT OF DISP=1 FOR SOURCE STRENGTHS INPUT INS0303900
C                 THIS WAY.                                            S0303910
C        Q1 - SOURCE STRENGTH FOR EACH SEASON IN MASS PER UNIT TIME    S0303920
C             (GRAMS/SEC).                                             S0303930
C                (EACH SEASON MUST BE SET BECAUSE THE PROGRAM ASSUMES  S0303940
C                 ZERO IS A VALID SOURCE STRENGTH). NOTE THAT THIS     S0303950
C                 PARAMETER IS USED ONLY IF DISP = 0 OR 1.             S0303960
C        DX1-  SOURCE COORDINATE IN THE X DIRECTION(METERS TO SOURCE CENTERS0303970
C              CARTESIAN COORDINATES OR POLAR DEPENDING ON ISW(15)     S0303980
C        DY1-  SOURCE COORDINATE IN THE Y DIRECTION(METERS TO SOURCE CENTERS0303990
C              CARTESIAN COORDINATES OR POLAR DEPENDING ON ISW(15).    S0304000
C        H1-  SOURCE STACK OR EMISSION HEIGHT (METERS) (BUILDING HEIGHT FORS0304010
C             TYPE1=1 EMISSIONS)                                       S0304020
C        HS1 - SOURCE BASE ELEVATION (METERS)                          S0304030
C        TS1- SOURCE GAS TEMPERATURE (DEGREES KELVIN) USED ONLY FOR TYPE1=0S0304040
C             SOURCES. IF TS1 IS LESS THAN OR EQUAL TO ZERO- THE ABSOLUTE  S0304050
C             VALUE PLUS THE AMBIENT AIR TEMPERATURE IS USED, OTHERWISE TS S0304060
C             MUST BE GREATER THAN OR EQUAL TO THE AMBIENT TEMPERATURE.    S0304070
C        VOL1 - VOLUMETRIC EMISSION RATE FOR TYPE1 = 0 SOURCES (CUBIC  S0304080
C               METERS PER SECOND). THE VOLUMETRIC EMISSION RATE IS    S0304090
C               DETERMINED BY THE PRODUCT OF THE INSIDE STACK AREA TIMES   S0304100
C               THE GAS EXIT VELOCITY                                  S0304110
C        S11 - LENGTH OF SHORT SIDE OF AREA SOURCE OR BUILDING, TYPE1=1OR2 S0304120
C              (METERS)                                                S0304130
C              TS1 IS EQUIVALENCED WITH S11 FOR INPUT                  S0304140
C        S21 - LENGTH OF LONG SIDE OF AREA SOURCE OR BUILDING, TYPE1=1OR2  S0304150
C              (METERS) (S21 SHOULD BE LESS THAN OR EQUAL TO 2*S11)    S0304160
C              VOL1 IS EQUIVALENCED WITH S21 FOR INPUT                 S0304170
C      RDS1 - INTERIOR STACK RADIUS FOR ELEVATED SOURCES (METERS). THIS  S03)4180
C              PARAMETER IS USED TO CALCULATE THE STACK EXIT VELOCITY FOR S03)4190
C              USE IN EQUATION (2-5) OF THE USERS MANUAL, WHICH ADJUSTS   S03)4200
C              THE CALCULATED PLUME RISE TO ACCOUNT FOR DOWNWASH EFFECTS  S03)4210
C              WHEN THE WIND SPEED AT STACK HEIGHT APPROACHES OR EXCEEDS  S03)4220
C              THE STACK EXIT VELOCITY.                                   S03)4230
C                  PLUME RISE = DELH   ; IF RDS1 = 0                      S03)4240
C                            OR                                           S03)4250
C                  PLUME RISE = DELH*F : IF RDS1 > 0                      S03)4260
C                         F = 1            ; IF V/U >= 1.5                S03)4270
C                         F = 0            ; IF V/U <= 1.0                S03)4280
C                         F = 3*(1.0-U/V) : IF 1 < V/U < 1.5              S03)4290
C                  WHERE U = WIND SPEED AT H1 AND V = EXIT VELOCITY       S03)4300
C      NVS1- NUMBER OF PARTICLE SIZE CATEGORIES FOR CONCENTRATION WITH   S03)4310
C             GRAVITATIONAL DEPOSITION  IF NSV IS GREATER THAN ZERO THE  S03)4320
C             PARAMETERS VS AND FRQ ARE READ BELOW AND CONCENTRATION     S03)4330
C             WITH GRAVITATIONAL SETTLING IS CALCULATED FOR THIS SOURCE  S03)4340
C-CARD GROUP 19B (THIS CARD GROUP IS READ ONLY IF DISP ABOVE = 3         S03)4350
C      (9F10.0) FORMAT                                                    S03)4360
C      QSS1 - SOURCE STRENGTH FOR EACH WIND SPEED, STABILITY AND SEASON  S03)4370
C              CATEGORY. NSEASN GROUPS OF CARDS ARE READ WITH NSTBLE      S03)4380
C              CARDS IN EACH GROUP AND NSPEED VALUES PER CARD  QSS1 IS    S03)4390
C              ASSUMED TO BE IN UNITS AS DEFINED UNDER Q1.                S03)4400
C-CARD GROUP 19C (THIS CARD GROUP IS READ ONLY IF NVS1 IS > 0)            S03)4410
C      (9F10.0) FORMAT                                                    S03)4420
C      VS1-  ARRAY CONTAINING THE VELOCITY FOR EACH PARTICLE SIZE         S03)4430
C             CATEGORY (METERS/SEC)                                       S03)4440
C      FRQ1- ARRAY CONTAINING THE PROPORTION OF THE TOTAL DISTRIBUTION   S03)4450
C             FOR EACH PARTICLE SIZE CATEGORY                             S03)4460
C                                                                         S03)4470
C*************************************************************************S03)4480
C                                                                         S03)4490
C************************************************************************ S03)4500
C                                                                         S03)4510
      INTEGER TITLE,TYPE,TYPE1,TYPE2,DISP,DATS,DATE1,DATE2,FMT,SFMT       S03)4520
C                                                                         S03)4530
      DIMENSION PP(6,6),SIGEU(6),SIGEL(6),IBRS(5),IARRY(7200),Q1(4),      S03)4540
     1SORC(54),SOR1C(54),SOR2C(54),ICFLG(4),IFMT(15),IPRT(200),           S03)4550
     2NMS(6),FMT(20),SFMT(20),X(1),Y(1),CON(NXXYY,5),Z(1),THETA(1)      S0304560
C                                                                       S0304570
      COMMON /DIM/ NSOURC,NKPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,NSCTOR,    S0304580
     1NXWYPT,TITLE(20),LUNT(5),LKNT(3),NSORT,ISZ(20),IOVRSN,NGROUP,NSTOPS0304590
     2,NSORX                                                            S0304600
      COMMON/MET/ TK,SIGEPU(6,6),SIGEPL(6,6),G,TA(6,4),HM(6,6,4),       S0304610
     1DPDZ(6,6),PHI(16),UBAR(6),FREQ(6,16,24),P(6,6),ZR,GAMMA1,GAMMA2   S0304620
     2,ROTATE,DECAY,HA,UTMX,UTMY                                        S0304630
      COMMON /SOR/ NUMSO,TYPE,QSS(6,6,4),DX,DY,H,TS,VOL,RDS,NVS,VS(20), S0304640
     1FRQ(20),DATE1(2),HS,NBX                                           S0304650
      COMMON /SOR1/ NUMSO1,TYPE1,QSS1(6,6,4),DX1,DY1,H1,TS1,VOL1,RDS1,  S0304660
     1NVS1,VS1(20),FRQ1(20),DISP,IDMY,HS1,NBX1                          S0304670
      COMMON /SOR2/ NUMSO2,TYPE2,QSS2(6,6,4),DX2,DY2,H2,TS2,VOL2,RDS2,  S0304680
     1NVS2,VS2(20),FRQ2(20),DATE2(2),HS2,NBX2                           S0304690
      COMMON /RBT/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0304700
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),NLINES   S0304710
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,DATS(2),IUNT,JUNT,IBLNK            S0304720
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTF,NOTTP,NINFL(3),NOTFL(3)      S0304730
C                                                                       S0304740
      EQUIVALENCE (SORC(1),NUMSO),(SOR1C(1),NUMSO1),(SOR2C(1),NUMSO2),  S0304750
     1(TS1,S11),(VOL1,S21),(TS2,S12),(VOL2,S22),(TS,S1),                S0304760
     2(VOL,S2),(IPRT(1),TK),(THETA(1),PHI(1)),(T,IT),                   S0304770
     3(NKPNTS,DUMMYN),(NUMSO2,DMYSO2),(NUMSO,DMYSO)                     S0304780
C                                                                       S0304790
C     INPUT DATA ARRAY DEFAULT VALUES                                   S0304800
      DATA SIGEU/.1745,.1080,.0735,.0465,.0350,.0235/                   S0304810
      DATA SIGEL/.1745,.1745,.1090,.0735,.0465,.0465/                   S0304820
      DATA PP/6*.1,.15,5*.1,.2,.15,4*.1,.25,.2,.15,3*.1,.3,.25,.2,.15,2*S0304830
     1.1,.4,.3,.2,.15,2*.1/                                             S0304840
      DATA UBRS/.75,2.5,4.3,6.8,9.5,12.5/                               S0304850
      DATA FMT/4H(6F1,4H0.0),18*1H /                                    S0304860
      DATA SFMT/4H(15,,4H211,,4H6F7.,4H0,4F,4H6.0),,4HF5.0,4H,12),13*1H /S0304870
      DATA IARRY/7000*0/                                                S0304880
      DATA IFMT/4HC T ,1HD,4HA A ,1HI,4HR P ,1HS,4HD E ,1HP,4H DAT,1HE,2S0304890
     1*1H ,4HENTR,1HY,4HMODY,2HYR/                                      S0304900
      DATA ICOM/1H,/,NMS/1H ,4HSEAS,4HONAL,1H ,4H  AN,4HNUAL/           S0304910
C                                                                       S0304920
C                                                                       S0304930
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C                                                                       S0304940
C***********************************************************************S0304950
C     HMIN IS THE MINIMUM HEIGHT FOR WIND SPEED CALCULATIONS  WHEN      S0304960
C     ISW(9) IS NOT EQUAL TO ZERO                                       S0304970
      HMIN = 5.0                                                        S0304980
C     LENREC IS THE LENGTH OF COMMON SOR                                S0304990
      LENREC = 197                                                      S0305000
C     LENMET IS THE LENGTH OF COMMON MET                                S0305010
      LENMET = 2648                                                     S0305020
      NXYPTS = NXPNTS*NYPNTS                                            S0305030
      LXYPTS = NXPNTS+NYPNTS+2*NXWYPT                                   S0305040
      NXY = NXPNTS+NYPNTS                                               S0305050
      NYX = NYPNTS+NXWYPT                                               S0305060
C     ZERO Z ARRAY                                                      S0305070
      DO 10 J=1,NXXYY                                                   S0305080
   10 Z(J) = 0.0                                                        S0305090
C     DEFINE NUMBER OF LINES PER PAGE                                   S0305100
      NLINES = 57                                                       S0305110
C     COMPRESS DATE INTO 6 LEFT JUSTIFIED CHARACTERS                    S0305120
C     DATS(1) CONTAINS MMDD, DATS(2) CONTAINS YY--                      S0305130
      CALL ADATE(DATS(1),IPRT(3))                                       S0305140
C     INITIALIZE MASS STORAGE RECORD POINTER                            S0305150
      JOREC = 0                                                         S0305160
C     DETERMINE IF SOURCE INVENTORY AND/OR CONCENTRATION LISTINGS ARE   S0305170
C     DESIRED                                                           S0305180
      IREPT = 0                                                         S0305190
      IF (ISW(2) .EQ. 2) IREPT = 1                                      S0305200
      IF (NGROUP .EQ. 0) GO TO 50                                       S0305210
      IF (ISW(3) .EQ. 0) GO TO 20                                       S0305220
      IREPT = 2                                                         S0305230
      GO TO 30                                                          S0305240
   20 IF (ISW(4) .EQ. 0) ISW(4) = 1                                     S0305250
      IREPT = 2                                                         S0305260
   30 CONTINUE                                                          S0305270
C     READ SOURCE GROUPING INFORMATION FOR CONCENTRATION REPORTS        S0305280
      READ (IUNT,9004) (NSOGRP(I),I=1,NGROUP)                           S0305290
      L = 0                                                             S0305300
      DO 40 N=1,NGROUP                                                  S0305310
   40 L = L+NSOGRP(N)
      READ (IUNT,9003) (IDSOR(I),I=1,L)                                 S0305320
C     DEFINE MASS STORAGE RANDOM ACCESS FILE 12                         S0305330
   50 CONTINUE                                                          S0305340
      IF (ISW(1) .EQ. 0) GO TO 70                                       S0305350
      IF (NSORX .EQ. 0) GO TO 60                                        S0305360
      NSORY = NSORX                                                     S0305370
      GO TO 80                                                          S0305380
   60 NSORY = NSORY+NSOURC                                              S0305390
      GO TO 80                                                          S0305400
   70 IF (NSORX .LE. 0) NSORX = NSOURC                                  S0305410
      NSORY = NSORX                                                     S0305420
   80 CONTINUE                                                          S0305430
      IF (IREPT .EQ. 0) GO TO 90                                        S0305440
      MSREC = NXYPTS+NXWYPT                                             S0305450
      IF (LENREC .GT. MSREC) MSREC = LENREC                             S0305460
C     ADD EXTRA WORD PER RECORD                                         S0305470
      MSREC = MSREC+1                                                   S0305480
      NORECS = NSORY*(NSEASN+1)                                         S0305490
C     SET UP UNIVAC JCL AND ASSIGN MASS STOAGE UNIT 12, NUMBER OF       S0305500
C     RECORDS=NORECS, WORDS PER RECORD=MSREC, L ERROR FLAG IF NEG.,     S0305510
C     JUNT=PRINTER.                                                     S0305520
      CALL ASSIGN(NORECS,MSREC,L,JUNT)                                  S0305530
      IF (L .LT. 0) GO TO 2360                                          S0305540
C     DYNAMICALLY DEFINE MASS STORAGE UNIT 12 AS RANDOM ACCESS -        S0305550
C     NO. OF RECS.=NORECS, NO. WORDS PER REC.=MSREC, 5=BINARY           S0305560
C     UNFORMATTED FILE, INCMA = ASSOCIATE VARIABLE - RECORD POINTER.    S0305570
      CALL DEFFIL(12,NORECS,MSREC,5,INCMA)                              S0305580
C     IS DATA READ FROM INPUT MASTER TAPE                               S0305590
   90 IF (ISW(1) .EQ. 0) GO TO 120                                      S0305600
C     READ REFERENCE GRID SYSTEM FROM TAPE, LXYPTS WORDS GO TO X        S0305610
      CALL INPOUP(1,X,LXYPTS)                                           S0305620
      IF (NOGO .EQ. 1) WRITE (JUNT,9030) IT1REC                         S0305630
      IF (NOGO .NE. 0) GO TO 2310                                       S0305640
C     READ TERRAIN HEIGHTS FROM TAPE IF PRESENT, NXXYY WORDS            S0305650
      CALL INPOUP(1,Z,NXXYY)                                            S0305660
      IF (NOGO .EQ. 1) WRITE (JUNT,9030) IT1REC                         S0305670
      IF (NOGO .NE. 0) GO TO 2310                                       S0305680
                                                                        S0305690
      DO 100 J=1,NXXYY                                                  S0305700
      IF (Z(J) .LE. 0.0) GO TO 100                                      S0305710
      ISW(9) = 1                                                        S0305720
      GO TO 110                                                         S0305730
  100 CONTINUE                                                          S0305740
  110 CONTINUE                                                          S0305750
C     READ METEOROLOGY FROM MASTER TAPE, LENMET WORDS GO TO TK          S0305760
      CALL INPOUP(1,TK,LENMET)                                          S0305770
      IF (NOGO .EQ. 1) WRITE (JUNT,9030) IT1REC                         S0305780
      IF (NOGO .NE. 0) GO TO 2310                                       S0305790
      IF (ISW(8) .EQ. 2) GO TO 270                                      S0305800
      IF (ISW(1) .EQ. 2) GO TO 310                                      S0305810
      GO TO 420                                                         S0305820
  120 CONTINUE                                                          S0305830
C     READ REFERENCE GRID SYSTEM AND MET VIA CARD                       S0305840
      IF (NXPNTS .LE. 0) GO TO 180                                      S0305850
      J = 8                                                             S0305860
      IF (J .GT. NXPNTS) J = NXPNTS                                     S0305870
      DO 130 I=1,J                                                      S0305880
  130 X(I) = 0.0                                                        S0305890
      READ (IUNT,9005) (X(I),I=1,J)                                     S0305900
      IF (NXPNTS .LE. 3) GO TO 170                                      S0305910
      DO 140 I=3,J                                                      S0305920
      IF (X(I)) 160,140,160                                             S0305930
  140 CONTINUE                                                          S0305940
      A1 = X(2)                                                         S0305950
      DO 150 I=2,NXPNTS                                                 S0305960
  150 X(I) = X(I-1)+A1                                                  S0305970
      GO TO 170                                                         S0305980
  160 IF (NXPNTS .LE. 9) GO TO 170                                      S0305990
      READ (IUNT,9005) (X(I),I=9,NXPNTS)                                S0306000
  170 CONTINUE                                                          S0306010
  180 IF (NXWYPT .LE. 0) GO TO 190                                      S0306020
      READ (IUNT,9005) (X(NXY+I),I=1,NXWYPT)                            S0306030
  190 IF (NYPNTS .LE. 0) GO TO 250                                      S0306040
      J = 8                                                             S0306050
      IF (J .GT. NYPNTS) J = NYPNTS                                     S0306060
      DO 200 I=1,J                                                      S0306070
  200 Y(I) = 0.0
      READ (IUNT,9005) (Y(I),I=1,J)                                    S0306080
      IF (NYPNTS .LE. 3) GO TO 240                                     S0306090
      DO 210 I=3,J                                                     S0306100
      IF (Y(I)) 230,210,230                                            S0306110
  210 CONTINUE                                                         S0306120
      A1 = Y(2)                                                        S0306130
      DO 220 I=2,NYPNTS                                                S0306140
  220 Y(I) = Y(I-1)+A1                                                 S0306150
      GO TO 240                                                        S0306160
  230 IF (NYPNTS .LE. 8) GO TO 240                                     S0306170
      READ (IUNT,9005) (Y(I),I=9,NYPNTS)                               S0306180
  240 CONTINUE                                                         S0306190
  250 IF (NXWYPT .LE. 0) GO TO 260                                     S0306200
      READ (IUNT,9005) (Y(NYX+I),I=1,NXWYPT)                           S0306210
  260 CONTINUE                                                         S0306220
      IF (ISW(8) .EQ. 0) GO TO 310                                     S0306230
  270 IF (NYPNTS .LE. 0) GO TO 290                                     S0306240
      DO 280 J=1,NYPNTS                                                S0306250
      K = (J-1)*NXPNTS                                                 S0306260
  280 READ (IUNT,9005) (Z(I+K),I=1,NXPNTS)                             S0306270
  290 IF (NXWYPT .LE. 0) GO TO 300                                     S0306280
      READ (IUNT,9005) (Z(I+NXYPTS),I=1,NXWYPT)                        S0306290
  300 CONTINUE                                                         S0306300
      IF (ISW(1) .EQ. 1) GO TO 420                                     S0306310
  310 IF (ISW(11) .GT. 0) READ (IUNT,9002) (FMT(I),I=1,13)             S0306320
      DO 320 K=1,NSEASN                                                S0306330
      DO 320 I=1,NSTBLE                                                S0306340
      KN = 4*(I-1)+K                                                   S0306350
      DO 320 N=1,NSCTOR                                                S0306360
  320 READ (IUNT,9005) (FREQ(J,N,KN),J=1,NSPEED)                       S0306370
      DO 330 K=1,NSEASN                                                S0306380
  330 READ (IUNT,9005) (TA(I,K),I=1,NSTBLE)                            S0306390
      DO 340 K=1,NSEASN                                                S0306400
      DO 340 I=1,NSTBLE                                                S0306410
  340 READ (IUNT,9005) (HM(J,I,K),J=1,NSPEED)                          S0306420
      DO 350 I=1,NSTBLE                                                S0306430
  350 READ (IUNT,9005) (DPDZ(J,I),J=1,NSPEED)                          S0306440
                                                                       S0306450
      READ (IUNT,9001) ROTATE,TK,HA,UTMX,UTMY,G,ZR,GAMMA1,GAMMA2,DECAY   S0306460
      DO 360 I=1,NSTBLE                                                  S0306470
  360 READ (IUNT,9005) (SIGEPU(J,I),J=1,NSPEED)                          S0306480
      IF (ISW(16) .EQ. 0) GO TO 380                                      S0306490
      DO 370 I=1,NSTBLE                                                  S0306500
  370 READ (IUNT,9005) (SIGEPL(J,I),J=1,NSPEED)                          S0306510
      GO TO 400                                                          S0306520
  380 CONTINUE                                                           S0306530
      DO 390 I=1,NSTBLE                                                  S0306540
      DO 390 J=1,NSPEED                                                  S0306550
  390 SIGEPL(J,I) = SIGEPU(J,I)                                          S0306560
  400 CONTINUE                                                           S0306570
      READ (IUNT,9005) (UBAR(J),J=1,NSPEED)                              S0306580
      DO 410 I=1,NSTBLE                                                  S0306590
  410 READ (IUNT,9005) (P(J,I),J=1,NSPEED)                               S0306600
      READ (IUNT,9005) (THETA(N),N=1,NSCTOR)                             S0306610
C     PROVIDE DATA INPUT DEFAULT VALUES                                  S0306620
  420 DO 450 J=1,NSPEED                                                  S0306630
      IF (UBAR(J) .LE. 0.0) UBAR(J) = UBRS(J)                            S0306640
      DO 450 I=1,NSTBLE                                                  S0306650
      IF (P(J,I) .LE. 0.0) P(J,I) = PP(J,I)                              S0306660
      IF (ISW(16) .NE. 0) GO TO 440                                      S0306670
      IF (ISW(17) .EQ. 0) GO TO 430                                      S0306680
      IF (SIGEPU(J,I) .LE. 0.0) SIGEPU(J,I) = SIGEL(I)                   S0306690
      IF (SIGEPL(J,I) .LE. 0.0) SIGEPL(J,I) = SIGEL(I)                   S0306700
      GO TO 450                                                          S0306710
  430 IF (SIGEPU(J,I) .LE. 0.0) SIGEPU(J,I) = SIGEU(I)                   S0306720
      IF (SIGEPL(J,I) .LE. 0.0) SIGEPL(J,I) = SIGEU(I)                   S0306730
      GO TO 450                                                          S0306740
  440 IF (SIGEPU(J,I) .LE. 0.0) WRITE (JUNT,9042) J,I                    S0306750
      IF (SIGEPL(J,I) .LE. 0.0) WRITE (JUNT,9043) J,I                    S0306760
  450 CONTINUE                                                           S0306770
      DO 460 J=1,NSEASN                                                  S0306780
      A1 = TA(1,J)                                                       S0306790
      DO 460 I=2,NSTBLE                                                  S0306800
      IF (TA(I,J) .GT. 0.0) A1 = TA(I,J)                                 S0306810
      IF (TA(I,J) .LE. 0.0) TA(I,J) = A1                                 S0306820
  460 CONTINUE                                                           S0306830
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      A1 = 0.0                                                          S0306840
      DO 470 K=1,NSEASN                                                 S0306850
      DO 470 J=1,NSTBLE                                                 S0306860
      IF (HM(1,J,K) .LE. 0.0) HM(1,J,K) = A1                            S0306870
      B1 = HM(1,J,K)                                                    S0306880
      A1 = B1                                                           S0306890
      DO 470 I=2,NSPEED                                                 S0306900
      IF (HM(I,J,K) .GT. 0.0) B1 = HM(I,J,K)                            S0306910
      IF (HM(I,J,K) .LE. 0.0) HM(I,J,K) = B1                            S0306920
  470 CONTINUE                                                          S0306930
      IF (TK .LE. 0.0) TK = 1.0E6                                       S0306940
      IF (G .LE. 0.0) G = 9.8                                           S0306950
      IF (ZR .LE. 0.0) ZR = 6.096                                       S0306960
      IF (GAMMA1 .LE. 0.0) GAMMA1 = 0.6                                 S0306970
      IF (GAMMA2 .LE. 0.0) GAMMA2 = 0.66                                S0306980
      IF (PHI(1) .GT. 0.0.OR PHI(2) .GT. 0.0) GO TO 490                 S0306990
      DO 480 N=1,NSCTOR                                                 S0307000
  480 PHI(N) = 22.5*FLOAT(N-1)                                          S0307010
  490 CONTINUE                                                          S0307020
      IF (ISW(2) .EQ. 0) GO TO 500                                      S0307030
C     INITIALIZE OUTPUT MASTER TAPE, 58 WORDS FROM NXPNTS GO TO TAPE    S0307040
C     OUTPUT BUFFER.                                                    S0307050
      CALL INPOUP(2,DUMMYN,58)                                          S0307060
      IF (NOGO .NE. 0) GO TO 2340                                       S0307070
C     WRITE LXYPTS WORDS TO TAPE OUTPUT BUFFER FROM X                   S0307080
      CALL INPOUP(2,X,LXYPTS)                                           S0307090
      IF (NOGO .NE. 0) GO TO 2340                                       S0307100
C     WRITE ELEVATIONS, NXXYY WORDS, FROM Z TO OUTPUT BUFFER            S0307110
      CALL INPOUP(2,Z,NXXYY)                                            S0307120
C     WRITE LENMET WORDS TO OUTPUT BUFFER FROM TK                       S0307130
      CALL INPOUP(2,TK,LENMET)                                          S0307140
      IF (NOGO .NE. 0) GO TO 2340                                       S0307150
  500 CONTINUE                                                          S0307160
C     READ SOURCE DATA FORMAT IF ISW(12) IS NON-ZERO                    S0307170
      IF (ISW(12) .NE. 0) READ (IUNT,9002) (SFMT(I),I=1,13)             S0307180
C     SET PROGRAM AND MODEL CONSTANTS                                   S0307190
      RADIAN = .01745329                                                S0307200
      ZRI = 1.0/ZR                                                      S0307210
      CNST = 0.5*2.50662827                                             S0307220
      A1 = G*.31830988                                                  S0307230
      B1 = 3.0/(2.0*GAMMA1*GAMMA1)                                      S0307240
      C1 = 3.0/(GAMMA2*GAMMA2)                                          S0307250
      E1 = 1.0/2.15                                                     S0307260
      D1 = 0.5*E1                                                       S0307270
      PP1 = 2.0*.3989423*TK                                             S0307280
C     MAKE SURE THE TOTAL FREQUENCY OF OCCURRENCE FOR EACH SEASON IS 1.0S0307290
      DO 550 K=1,NSEASN                                                 S0307300
      DX = 0.0                                                          S0307310
      DO 510 I=1,NSTBLE                                                 S0307320
      KN = 4*(I-1)+K                                                    S0307330
      DO 510 N=1,NSCTOR                                                 S0307340
      DO 510 J=1,NSPEED                                                 S0307350
  510 DX = DX+FREQ(J,N,KN)                                              S0307360
      DX = 1.0/DX                                                       S0307370
      IF (DX-1.0) 520,530,520                                           S0307380
  520 WRITE (JUNT,9035) K,DX                                            S0307390
  530 CONTINUE                                                          S0307400
      DO 540 I=1,NSTBLE                                                 S0307410
      KN = 4*(I-1)+K                                                    S0307420
      DO 540 N=1,NSCTOR                                                 S0307430
      DO 540 J=1,NSPEED                                                 S0307440
  540 FREQ(J,N,KN) = FREQ(J,N,KN)*DX                                    S0307450
  550 CONTINUE                                                          S0307460
C     CHECK UNITS OF SIGEPU AND SIGEPL                                  S0307470
      DO 570 I=1,NSTBLE                                                 S0307480
      DO 570 J=1,NSPEED                                                 S0307490
      IF (SIGEPL(J,I) .LT. 1.0) GO TO 560                               S0307500
      SIGEPL(J,I) = SIGEPL(J,I)*RADIAN                                  S0307510
  560 IF (SIGEPU(J,I) .LT. 1.0) GO TO 570                               S0307520
      SIGEPU(J,I) = SIGEPU(J,I)*RADIAN                                  S0307530
  570 CONTINUE                                                          S0307540
      IF (ISW(5) .EQ. 0) GO TO 760                                      S0307550
C                                                                       S0307560
C***********************************************************************S0307570
C     LIST DATA CARD INPUT PARAMETERS OTHER THAN SOURCE CARDS           S0307580
      LINE = NLINES                                                     S0307590
      CALL TITLR(0,37,1)                                                S0307500
      WRITE (JUNT,9006) NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,      S0307510
     1 NSCTOR,NGROUP,NSTOP,NXWYPT                                       S0307520
      WRITE (JUNT,9040) NSORY                                           S0307530
      WRITE (JUNT,9007) ISW(1),ISW(2),(ISW(I),I=2,4),(ISW(I),I=6,9)     S0307540
      WRITE (JUNT,9041) (ISW(I),I=11,17)                                S0307550
      WRITE (JUNT,9008) TK,G,ZR,GAMMA1,GAMMA2,ROTATE,DECAY,HA,UTMX,UTMY S0307560
      IF (NXPNTS .LE. 0) GO TO 580                                      S0307570
      CALL TITLR(1,(NXPNTS+7)/8+3,1)                                    S0307580
      WRITE (JUNT,9009) (X(I),I=1,NXPNTS)                               S0307590
      K = 1                                                             S0307700
      IF (ISW(13) .NE. 0) K = 3                                         S0307710
      CALL TITLR(1,(NYPNTS+7)/8+3,1)                                    S0307720
      WRITE (JUNT,9010) MUNT(K),MUNT(K+1),(Y(J),J=1,NYPNTS)             S0307730
  580 IF (NXWYPT .EQ. 0) GO TO 590                                      S0307740
      K = 1                                                             S0307750
      IF (ISW(14) .NE. 0) K = 2                                         S0307760
      CALL TITLR(1,(NXWYPT*2+9)/10+3,1)                                 S0307770
      WRITE (JUNT,9034) MUNT(K),MUNT(K+1),(X(NXY+I),Y(NYX+I),I=1,NXWYPT)S0307780
  590 CONTINUE                                                          S0307790
      IF (ISW(8) .EQ. 0) GO TO 600                                      S0307800
      KK = 99                                                           S0307810
      CALL OUTPT(KK,K,IB,NMS,IPRT,X,Y,Z)                                S0307820
  600 CONTINUE                                                          S0307830
      IF (LINE+9 .GT. NLINES) LINE = NLINES                             S0307840
      DO 610 K=1,NSEASN                                                 S0307850
      CALL TITLR(1,1,1)                                                 S0307860
      IF (IPC .EQ. 0.AND.K .GT. 1) GO TO 610                            S0307870
      WRITE (JUNT,9011) (I,I=1,6)                                       S0307880
      LINE = LINE+5                                                     S0307890
  610 WRITE (JUNT,9012) K,(TA(I,K),I=1,NSTBLE)                          S0307900
      IF (LINE+11 .GT. NLINES) LINE = NLINES                            S0307910
      DO 660 K=1,NSEASN                                                 S0307920
      DO 660 I=1,NSTBLE                                                 S0307930
      CALL TITLR(1,1,1)                                                 S0307940
      IF (IPC .EQ. 0) GO TO 650                                         S0307950
  620 WRITE (JUNT,9013)                                                 S0307960
      LINE = LINE+3                                                     S0307970
      GO TO 640                                                         S0307980
  630 CALL TITLR(1,3,1)                                                 S0307990
      LINE = LINE-2                                                     S0308000
      IF (IPC .NE. 0) GO TO 620                                         S0308010
      LINE = LINE-1                                                     S0308020
  640 WRITE (JUNT,9014) K,(L,L=1,6)                                     S0308030
      LINE = LINE+3                                                     S0308040
      GO TO 660                                                         S0308050
  650 IF (K .EQ. 1.AND.I .EQ. 1) GO TO 620                              S0308060
      IF (I .EQ. 1) GO TO 630                                           S0308070
  660 WRITE (JUNT,9015) I,(HM(J,I,K),J=1,NSPEED)                        S0308080
      IF (LINE+10+NSCTOR .GT. NLINES) LINE = NLINES                     S0308090
      DO 710 K=1,NSEASN                                                 S0308100
      DO 710 I=1,NSTBLE                                                 S0308110
      KN = 4*(I-1)+K                                                    S0308120
      DO 710 N=1,NSCTOR                                                 S0308130
      CALL TITLR(1,1,1)                                                 S0308140
      IF (IPC .EQ. 0) GO TO 700                                         S0308150
      LINE = LINE-1                                                     S0308160
  670 WRITE (JUNT,9016)                                                 S0308170
      LINE = LINE+2                                                     S0308180
      GO TO 690                                                         S0308190
  680 CALL TITLR(1,9,1)                                                 S0308200
      LINE = LINE-9                                                     S0308210
      IF (IPC .NE. 0) GO TO 670                                         S0308220
  690 WRITE (JUNT,9017) K                                               S0308230
      WRITE (JUNT,9018) I,(J,J=1,6),(UBAR(J),J=1,6)                     S0308240
      LINE = LINE+9                                                     S0308250
      GO TO 710                                                         S0308260
  700 IF (K .EQ. 1.AND.I .EQ. 1.AND.N .EQ. 1) GO TO 670                 S0308270
      IF (N .EQ. 1) GO TO 690                                           S0308280
  710 WRITE (JUNT,9019) PHI(N),(FREQ(J,N,KN),J=1,NSPEED)                S0308290
      CALL TITLR(1,5+NSTBLE,1)                                          S0308300
      WRITE(JUNT,9020)                                                  S0308310
      WRITE (JUNT,9021) (J,J=1,NSPEED)                                  S0308320
      DO 720 I=1,NSTBLE                                                 S0308330
  720 WRITE (JUNT,9015) I,(SIGEPU(J,I),J=1,NSPEED)                      S0308340
      CALL TITLR(1,5+NSTBLE,1)                                          S0308350
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                                                                        S0308360
      WRITE(JUNT,9022)                                                  S0308370
      WRITE (JUNT,9021) (J,J=1,NSPEED)                                  S0308380
      DO 730 I=1,NSTBLE                                                 S0308390
  730 WRITE (JUNT,9015) I,(SIGEPL(J,I),J=1,NSPEED)                      S0308400
      CALL TITLR(1,5+NSTBLE,1)                                          S0308410
      WRITE(JUNT,9023)                                                  S0308420
      WRITE (JUNT,9021) (J,J=1,NSPEED)                                  S0308430
      DO 740 I=1,NSTBLE                                                 S0308440
  740 WRITE (JUNT,9015) I,(DPDZ(J,I),J=1,NSPEED)                        S0308450
      CALL TITLR(1,5+NSTBLE,1)                                          S0308460
      WRITE(JUNT,9024)                                                  S0308470
      WRITE (JUNT,9021) (J,J=1,NSPEED)                                  S0308480
      DO 750 I=1,NSTBLE                                                 S0308490
  750 WRITE (JUNT,9015) I,(P(J,I),J=1,NSPEED)                           S0308500
  760 CONTINUE                                                          S0308510
      DO 770 N=1,NSCTOR                                                 S0308520
      PHI(N) = PHI(N)-ROTATE                                            S0308530
      RO = PHI(N)*RADIAN                                                S0308540
      PHC(N) = COS(RO)                                                  S0308550
  770 PHS(N) = SIN(RO)                                                  S0308560
      DPHI = ABS(PHI(2)-PHI(1))                                         S0308570
      TR = DPHI*RADIAN                                                  S0308580
      TNN = TAN(TR)                                                     S0308590
      E2 = 1.0/TAN(0.5*TR)                                              S0308600
      IF (ISW(14) .EQ. 0.OR.NXWYPT .EQ. 0) GO TO 810                    S0308610
      IF (UTMX) 790,780,790                                             S0308620
  780 IF (UTMY) 790,810,790                                             S0308630
  790 DO 800 I=1,NXWYPT                                                 S0308640
      S = Y(I+NYX)*RADIAN                                               S0308650
      Y(I+NYX) = X(I+NXY)*COS(S)+UTMY                                   S0308660
  800 X(I+NXY) = X(I+NXY)*SIN(S)+UTMX                                   S0308670
      ISW(14) = 0                                                       S0308680
  910 CONTINUE                                                          S0308690
      IF (ISW(8) .EQ. 0) HA = 0.0                                       S0308700
C                                                                       S0308710
C***********************************************************************S0308720
C     START LOOP OVER CARD AND TAPE INPUT SOURCES                       S0308730
      M1 = 0
      MSIN = 0                                                          S0308740
      NPF1 = 0                                                          S0308750
      IFL1 = 0                                                          S0308760
      IFL2 = 0                                                          S0308770
      IFLG = 1                                                          S0308780
      IF (ISW(1) .EQ. 0) IFL2 = 1                                       S0308790
      IF (NSOURC .LT. 1) IFL1 = 1                                       S0308800
      LINE = NLINES+1                                                   S0308810
      ITC = 0                                                           S0308820
  820 DO 830 I=1,4                                                      S0308830
  830 ICFLG(I) = 0                                                      S0308840
      IF (IFLG .EQ. 3) GO TO 960                                        S0308850
C     IS END OF CARD DATA                                               S0308860
      IF (IFL1 .EQ. 1) GO TO 960                                        S0308870
      M1 = M1+1                                                         S0308880
      IF (M1 .GT. NSOURC) GO TO 940                                     S0308890
C     READ CARD SOURCE DATA                                             S0308900
      READ (IUNT,SFMT,END=940) NUMSQ1,TYPE1,DISP,Q1,DX1,DY1,H1,HS1,TS1, S0308910
     1VOL1,RDS1,NVS1                                                    S0308920
      MSIN = MSIN+1                                                     S0308930
      NBX1 = 0                                                          S0308940
      IF (DISP .NE. 3) GO TO 850                                        S0308950
      DO 840 K=1,NSEASN                                                 S0308960
      DO 840 I=1,NSTBLE                                                 S0308970
  840 READ (IUNT,9005) (QSS1(J,I,K),J=1,NSPEED)                         S0308980
      NBX1 = 1                                                          S0308990
      DISP = 0                                                          S0309000
      GO TO 870                                                         S0309010
  850 IF (DISP .EQ. 2) GO TO 890                                        S0309020
      DO 860 K=1,NSEASN                                                 S0309030
      DO 860 I=1,NSTBLE                                                 S0309040
      DO 860 J=1,NSPEED                                                 S0309050
  860 QSS1(J,I,K) = Q1(K)                                               S0309060
  870 CONTINUE                                                          S0309070
      IF (TYPE1 .NE. 0.OR.DISP .NE. 0) GO TO 890                        S0309080
      IF (TS1 .LE. 0.0) GO TO 890                                       S0309090
      DO 880 K=1,NSEASN                                                 S0309100
      DO 880 I=1,NSTBLE                                                 S0309110
      IF (TS1 .GE. TA(I,K)) GO TO 880                                   S0309120
      TS1 = 0.0                                                         S0309130
      GO TO 890                                                         S0309140
  880 CONTINUE                                                          S0309150
  890 CONTINUE                                                          S0309160
      IF (NVS1 .GT. 0) READ (IUNT,9005) (VS1(I),FR91(I),I=1,NVS1)       S0309170
      IF (ISW(6) .EQ. 0) GO TO 950                                      S0309180
C     LIST INPUT CARD SOURCES                                           S0309190
      CALL TITLR(ITC,1,2)                                               S0309200
      IF (IPC .EQ. 0) GO TO 900                                         S0309210
      ITC = 1                                                           S0309220
      K = 1                                                             S0309230
      IF (ISW(15) .NE. 0) K = 3                                         S0309240
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(I),I=3,8),MUNT(K),   S0309250
     1MUNT(K+1)                                                         S0309260
      LINE = LINE+6                                                     S0309270
  900 WRITE (JUNT,9026) DISP,NUMS91,TYPE1,(QSS1(1,1,L),L=1,4),DX1,DY1,  S0309280
     1 H1,HS1,TS1,VOL1,RDS1                                             S0309290
      IF (NBX1 .EQ. 0) GO TO 920                                        S0309300
      DO 910 I=2,NSTBLE                                                 S0309310
      DO 910 J=1,NSPEED                                                 S0309320
      CALL TITLR(1,1,2)                                                 S0309330
      IF (IPC .EQ. 0) GO TO 910                                         S0309340
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(L),L=3,8),MUNT(K),   S0309350
     1MUNT(K+1)                                                         S0309360
      LINE = LINE+6                                                     S0309370
  910 WRITE (JUNT,9039) (QSS1(J,I,L),L=1,4),J,I                         S0309380
  920 CONTINUE                                                          S0309390
      IF (NVS1 .LE. 0) GO TO 950                                        S0309400
      CALL TITLR(1,2+(NVS1-2)/4,2)                                      S0309410
      IF (IPC .EQ. 0) GO TO 930                                         S0309420
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(I),I=3,8),MUNT(K),   S0309430
     1MUNT(K+1)                                                         S0309440
      LINE = LINE+6                                                     S0309450
  930 CONTINUE                                                          S0309460
      WRITE (JUNT,9031) NVS1,(VS1(I),FR91(I),I=1,NVS1)                  S0309470
      GO TO 950                                                         S0309480
  940 IFL1 = 1                                                          S0309490
  950 IF (IFLG .EQ. 2) GO TO 1030                                       S0309500
C     HAS END OF TAPE DATA OCCURRED                                     S0309510
  960 IF (IFL2 .EQ. 1) GO TO 1030                                       S0309520
C     READ LENREC WORDS FROM INPUT TAPE BUFFER INTO NUMSQ2              S0309530
  970 CALL INPOUP(-1,DMYSQ2,LENREC)                                     S0309540
      IF (NOGO .EQ. 1) GO TO 1020                                       S0309550
      IF (NOGO .GT. 1) GO TO 2310                                       S0309560
      IF (NUMSQ2 .GE. 999999) GO TO 970                                 S0309570
      IF (NUMSQ2 .GT. NSTOP) GO TO 1020                                 S0309580
      NSIN = NSIN+1                                                     S0309590
      IF (ISW(7) .NE. 1) GO TO 1030                                     S0309600
C     LIST INPUT TAPE SOURCES                                           S0309610
      CALL TITLR(ITC,1,2)                                               S0309620
      IF (IPC .EQ. 0) GO TO 980                                         S0309630
      ITC = 1                                                           S0309640
      K = 1                                                             S0309650
      IF (ISW(15) .NE. 0) K = 3                                         S0309660
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(I),I=3,8),MUNT(K),   S0309670
     1MUNT(K+1)                                                         S0309680
      LINE = LINE+6                                                     S0309690
  980 WRITE (JUNT,9027) NUMSQ2,TYPE2,(QSS2(1,1,L),L=1,4),DX2,DY2,       S0309700
     1 H2,HS2,TS2,VOL2,RDS2                                             S0309710
      IF (NBX2 .EQ. 0) GO TO 1000                                       S0309720
      DO 990 I=2,NSTBLE                                                 S0309730
      DO 990 J=1,NSPEED                                                 S0309740
      CALL TITLR(1,1,2)                                                 S0309750
      IF (IPC .EQ. 0) GO TO 990                                         S0309760
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(L),L=3,8),MUNT(K),   S0309770
     1MUNT(K+1)                                                         S0309780
      LINE = LINE+6                                                     S0309790
  990 WRITE (JUNT,9039) (QSS2(J,I,L),L=1,4),J,I                         S0309800
 1000 CONTINUE                                                          S0309810
      IF (NVS2 .LE. 0) GO TO 1030                                       S0309820
      CALL TITLR(1,2+(NVS2-2)/4,2)                                      S0309830
      IF (IPC .EQ. 0) GO TO 1010                                        S0309840
      WRITE (JUNT,9025) IFMT(1),IFMT(2),LKNT,(IFMT(I),I=3,8),MUNT(K),   S0309850
     1MUNT(K+1)                                                         S0309860
      LINE = LINE+6                                                     S0309870
 1010 CONTINUE                                                          S0309880
      WRITE (JUNT,9031) NVS2,(VS2(I),FRQ2(I),I=1,NVS2)                  S0309890
      GO TO 1030                                                        S0309900
 1020 IFL2 = 1                                                          S0309910
 1030 CONTINUE                                                          S0309920
      IF (IFL1 .EQ. 1) GO TO 1040                                       S0309930
      IF (IFL2 .NE. 1) GO TO 1050                                       S0309940
      GO TO 1120                                                        S0309950
 1040 IF (IFL2 .EQ. 1) GO TO 2030                                       S0309960
      GO TO 1090                                                        S0309970
 1050 IF (NUMSQ1 .LT. NUMSQ2) GO TO 1120                                S0309980
      IF (NUMSQ2 .LT. NUMSQ1) GO TO 1090                                S0309990
      IFLG = 1                                                          S0310000
C     CHECK CARD DISPOSITION                                            S0310010
      IF (DISP .EQ. 2) GO TO 1160                                       S0310020
      L = 1                                                             S0310030
      IF (DISP .EQ. 0) GO TO 1130                                       S0310040
      L = 2                                                             S0310050
      IF (NBX2 .EQ. 0) GO TO 1070                                       S0310060
      L = 1                                                             S0310070
      DISP = 0                                                          S0310080
      DO 1060 I=147,LENREC                                              S0310090
 1060 SOR1C(I) = SOR2C(I)                                               S0310100
      NBX1 = 0                                                          S0310110
      GO TO 1130                                                        S0310120
 1070 CONTINUE                                                          S0310130
C     CHANGE SOURCE STRENGTH AND CALCULATE SCALE FACTORS                S0310140
      DO 1080 K=1,NSEASN                                                S0310150
      QS1(K) = 0.0                                                      S0310160
      IF (QSS1(1,1,K) .GT. 0.0.AND.QSS2(1,1,K) .GT. 0.0) QS1(K) = QSS1(1S0310170
     1,1,K)/QSS2(1,1,K)                                                 S0310180
      DO 1080 I=1,NSTBLE                                                S0310190
      DO 1080 J=1,NSPEED                                                S0310200
 1080 QSS2(J,I,K) = QSS1(1,1,K)                                         S0310210
      DATE2(1) = DATS(1)                                                S0310220
      DATE2(2) = DATS(2)                                                S0310230
      GO TO 1100                                                        S0310240
C     TAPE INPUT ONLY                                                   S0310250
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 1090 L = 2                                                             S0310260
      IFLG = 3                                                          S0310270
 1100 DO 1110 I=1,LENREC                                                S0310280
 1110 SORC(I) = SOR2C(I)                                                S0310290
      GO TO 1160                                                        S0310300
C     CARD INPUT ONLY                                                   S0310310
 1120 L = 1                                                             S0310320
      IFLG = 2                                                          S0310330
      IF (DISP .NE. 0) GO TO 1150                                       S0310340
 1130 DO 1140 I=1,LENREC                                                S0310350
 1140 SORC(I) = SOR1C(I)                                                S0310360
      DATE1(1) = DATS(1)                                                S0310370
      DATE1(2) = DATS(2)                                                S0310380
      GO TO 1160                                                        S0310390
C     INCORRECT DISPOSITION CODE                                        S0310400
 1150 CALL TITLR(ITC,1,2)                                               S0310410
      ITC = 1                                                           S0310420
      WRITE (JUNT,9028) NUMSQ1,DISP                                     S0310430
C     RETURN FOR NEXT SOURCE CARD AND/OR TAPE RECORD                    S0310440
      GO TO 820                                                         S0310450
 1160 IF (IFLG .EQ. 1.AND.DISP .EQ. 2) GO TO 1190                       S0310460
C     IS TAPE OUTPUT DESIRED                                            S0310470
      IF (ISW(2) .EQ. 0) GO TO 1170                                     S0310480
C     WRITE LENREC WORDS FROM NUMSQ TO TAPE OUTPUT BUFFER               S0310490
      CALL INPOUP(2,DMYSQ,LENREC)                                       S0310500
      IF (NOGO .NE. 0) GO TO 2340                                       S0310510
C     ARE PRINTED REPORTS DESIRED                                       S0310520
 1170 IF (IREPT .EQ. 0) GO TO 1190                                      S0310530
      JOREC = JOREC+1                                                   S0310540
      IF (JOREC .EQ. 1) NSAVE = NUMSQ                                   S0310550
      INCMA = JOREC                                                     S0310560
C     WRITE MASS STORAGE LU 12, RECORD INCMA                            S0310570
      WRITE (12'INCMA) (SORC(I),I=1,LENREC)                             S0310580
C     SAVE RECORD NUMBER FOR THIS SOURCE                                S0310590
      I = 1                                                             S0310600
      IF (NUMSQ .LE. 7000) GO TO 1180                                   S0310610
      I = 2                                                             S0310620
      IF (NUMSQ .LE. 14000) GO TO 1180                                  S0310630
      I = 3                                                             S0310540
 1180 CONTINUE                                                          S0310550
      J = MOD(NUMSQ,7000)                                               S0310560
      IF (J .EQ. 0) J = 7000                                            S0310570
C     SHIFT JOREC INTO HIGH ORDER PART OF I, DEPENDING ON MLT(I)        S0310580
      I = JOREC*MLT(I)                                                  S0310590
C     LOGICAL ADD RECORD NUMBER TO IARRY                                S0310700
      IARRY(J) = OR(IARRY(J),I)                                         S0310710
 1190 CONTINUE                                                          S0310720
      IF (IFLG .EQ. 2) GO TO 1240                                       S0310730
      DO 1200 K=1,NSEASN                                                S0310740
C     READ NXXYY CONCENTRATION VALUES FROM TAPE BUFFER INTO CON(1,K)    S0310750
      CALL INPOUP(1,CON(1,K),NXXYY)                                     S0310760
      IF (NOGO .NE. 0) GO TO 2310                                       S0310770
 1200 CONTINUE                                                          S0310780
C     IS CONCENTRATION RECORD OUTPUT ONLY                               S0310790
      IF (IFLG .EQ. 3) GO TO 1990                                       S0310800
C     IS RECORD DELETED                                                 S0310810
      IF (DISP .EQ. 2) GO TO 820                                        S0310820
C     IS RECORD CHANGED OR RECALCULATED                                 S0310830
      IF (DISP .EQ. 0) GO TO 1240                                       S0310840
C     RECORD IS UPDATED WITH NEW SOURCE STRENGTH                        S0310850
      KK = 0                                                            S0310860
      DO 1230 K=1,NSEASN                                                S0310870
      ICFLG(K) = 1                                                      S0310880
      IF (QS1(K) .GT. 0.0) GO TO 1210                                   S0310890
      IF (QSS2(1,1,K) .LE. 0.0) GO TO 1210                              S0310900
      KK = 1                                                            S0310910
      ICFLG(K) = 0                                                      S0310920
 1210 CONTINUE                                                          S0310930
      DO 1220 J=1,NXXYY                                                 S0310940
 1220 CON(  J,K) = CON(  J,K)*QS1(K)                                    S0310950
 1230 CONTINUE                                                          S0310960
C     IS DATA OUTPUT ONLY                                               S0310970
      IF (KK .EQ. 0) GO TO 1990                                         S0310980
C     RECALCULATE FOR ICFLG(K) = 0                                      S0310990
 1240 CONTINUE                                                          S0311000
C                                                                       S0311010
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C***********************************************************************S0311020
C                                                                       S0311030
C     CALCULATE CONCENTRATION                                           S0311040
C                                                                       S0311050
      IF (ISW(8) .GT. 0) GO TO 1250                                     S0311060
      HS = 0.0                                                          S0311070
      GO TO 1260                                                        S0311080
 1250 IF (NVS .EQ. 0) GO TO 1260                                        S0311090
      HS = 0.0                                                          S0311100
      ISW(8) = 0.0                                                      S0311110
      WRITE (JUNT,9044)                                                 S0311120
      IF (HA .LE. 0.0) GO TO 1260                                       S0311130
      HA = 0.0                                                          S0311140
      IF (MSIN .LE. 1) GO TO 1260                                       S0311150
      WRITE (JUNT,9045)                                                 S0311160
      GO TO 2360                                                        S0311170
 1260 CONTINUE                                                          S0311180
      IF (ISW(15) .EQ. 0) GO TO 1270                                    S0311190
      C2 = DY*RADIAN                                                    S0311200
      DY = DX*COS(C2)+UTMY                                              S0311210
      DX = DX*SIN(C2)+UTMX                                              S0311220
 1270 CONTINUE                                                          S0311230
C     BEGIN PLUME RISE SECTION                                          S0311240
      IF (ISW(9) .EQ. 0) GO TO 1280                                     S0311250
      C2 = H                                                            S0311260
      IF (H .LT. HMIN) C2 = HMIN                                        S0311270
      C2 = C2*ZRI                                                       S0311280
      GO TO 1290                                                        S0311290
 1280 C2 = 1.0                                                          S0311300
      IF (H+HS .GT. ZR+HA) C2 = (H+HS-HA)*ZRI                           S0311310
 1290 CONTINUE                                                          S0311320
      WS = 0.0                                                          S0311330
      DO 1300 K=1,NSEASN                                                S0311340
      DO 1300 I=1,NSTBLE                                                S0311350
      DO 1300 J=1,NSPEED                                                S0311360
 1300 WS = WS+QSS(J,I,K)                                                S0311370
      IF (WS .LE. 0.0) GO TO 1510                                       S0311380
C     IS SOURCE AREA OR BUILDING EMISSION                               S0311390
      IF (TYPE .GT. 0) GO TO 1430
      A2 = A1*VOL                                                       S0311400
      B2 = H*10.0                                                       S0311410
      B3 = B2*B2*B1                                                     S0311420
C     BEGIN LOOP OVER STABILITY FOR ELEVATED SOURCE                     S0311430
      DO 1420 I=1,NSTBLE                                                S0311440
      DO 1420 J=1,NSPEED                                                S0311450
C     CALC UBAR AT H                                                    S0311460
      UBH = UBAR(J)*C2**P(J,I)                                          S0311470
      UBHI = 1.0/UBH                                                    S0311480
      FCT = 1.0                                                         S0311490
      IF (RDS .LE. 0.0) GO TO 1320                                      S0311500
      W = VOL/(3.1415926*RDS*RDS)                                       S0311510
      IF (W .GE. 1.5*UBH) GO TO 1320                                    S0311520
      IF (W .LE. UBH) GO TO 1310                                        S0311530
      FCT = 3.0*(1.0-UBH/W)                                             S0311540
      GO TO 1320                                                        S0311550
 1310 FCT = 0.0                                                         S0311560
 1320 CONTINUE                                                          S0311570
      D2 = B2*SIGEPU(J.I)                                               S0311580
C     IS THIS A STABLE ATMOSPHERE                                       S0311590
      IF (DPDZ(J,I) .GT. 0.0) GO TO 1360                                S0311600
C     NO ADIABITIC UNSTABLE                                             S0311610
      DO 1350 K=1,NSEASN                                                S0311620
      T = TS                                                            S0311630
      IF (T .LE. 0.0) T = ABS(T)+TA(I,K)                                S0311640
C     CALCULATE INITIAL BUOYANCY FLUX                                   S0311650
      F = A2*(1.0-TA(I,K)/T)                                            S0311660
C     CALCULATE PLUME RISE                                              S0311670
      DELH = ((F*B3)**.333333)*UBHI                                     S0311680
      DELH = DELH*FCT                                                   S0311690
C     CALCULATE PLUME HEIGHT                                            S0311700
      HP(J,I,K) = H+DELH                                                S0311710
C     CALCULATE VIRTUAL DISTANCE DUE TO VERTICAL SOURCE DIMENSION       S0311720
      XZ(J,I,K) = DELH*D1-D2                                            S0311730
      IF (XZ(J,I,K) .LT. 0.0) XZ(J,I,K) = 0.0                           S0311740
C     CALCULATE WIND SPEED AT PLUME HEIGHT                              S0311750
      IF (ISW(9) .EQ. 0) GO TO 1330                                     S0311760
      ZZ = HP(J,I,K)                                                    S0311770
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            IF (ZZ .LT. HMIN) ZZ = HMIN
            ZZ = ZZ*ZRI                                                     S0311780
            GO TO 1340                                                      S0311790
      1330  ZZ = 1.0                                                        S0311800
            IF (HP(J,I,K)+HS .GT. ZR+HA) ZZ = (HP(J,I,K)+HS-HA)*ZRI         S0311810
      1340  CONTINUE                                                        S0311820
            UBHP(J,I,K) = 1.0/(UBAR(J)*ZZ**P(J,I))                          S0311830
      1350  CONTINUE                                                        S0311840
            GO TO 1420                                                      S0311850
  C         STABLE ATMOSPHERE                                               S0311860
      1360  C4 = UBHI*C1                                                    S0311870
            C5 = B2*UBHI                                                    S0311880
            C3 = G*DPDZ(J,I)                                                S0311890
            C6 = 2.0*C4                                                     S0311900
            C7 = 3.1415926*UBH                                              S0311910
            DO 1410 K=1,NSEASN                                              S0311920
            T = TS                                                          S0311930
            IF (T .LE. 0.0) T = ABS(T)+TA(I,K)                              S0311940
            S = C3/TA(I,K)                                                  S0311950
  C         CALCULATE INITIAL BUOYANCY FLUX                                 S0311960
            F = A2*(1.0-TA(I,K)/T)/S                                        S0311970
            SQ = SQRT(S)                                                    S0311980
            E3 = C7/SQ                                                      S0311990
            IF (E3 .LT. B2) GO TO 1370                                      S0312000
  C         CALCULATE PLUME RISE                                            S0312010
            DELH = (C4*F*(1.0-COS(SQ*C5)))                                  S0312020
            XR = D2                                                         S0312030
            GO TO 1380                                                      S0312040
  C         CALCULATE PLUME RISE                                            S0312050
      1370  DELH = (C6*F)                                                   S0312060
            XR = E3*SIGEPU(J,I)                                             S0312070
      1380  DELH = DELH**.333333                                            S0312080
            DELH = DELH*FCT                                                 S0312090
  C         CALCULATE PLUME RISE                                            S0312100
            HP(J,I,K) = H+DELH                                              S0312110
  C         CALCULATE VIRTUAL DISTANCE DUE TO VIRTICAL SOURCE DIMENSION     S0312120
            XZ(J,I,K) = DELH*D1-XR                                          S0312130
            IF (XZ(J,I,K) .LT. 0.0) XZ(J,I,K) = 0.0                         S0312140
                                                                            S0312150
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C       CALCULATE WIND SPEED AT PLUME HEIGHT                            S0312160
        IF (ISW(9) .EQ. 0) GO TO 1390                                   S0312170
        ZZ = HP(J,I,K)                                                  S0312180
        IF (ZZ .LT. HMIN) ZZ = HMIN                                     S0312190
        ZZ = ZZ*ZRI                                                     S0312200
        GO TO 1400                                                      S0312210
   1390 ZZ = 1.0                                                        S0312220
        IF (HP(J,I,K)+HS .GT. ZR+HA) ZZ = (HP(J,I,K)+HS-HA)*ZRI         S0312230
   1400 CONTINUE                                                        S0312240
        UBHP(J,I,K) = 1.0/(UBAR(J)*ZZ**P(J,I))                          S0312250
   1410 CONTINUE                                                        S0312260
   1420 CONTINUE                                                        S0312270
C       VIRTUAL DISTANCE AND SOURCE RADIUS EFFECTIVELY ZERO             S0312280
        XY = 0.0                                                        S0312290
        RO = 0.0                                                        S0312300
C       END OF PLUME RISE FOR ELEVATED SOURCES                          S0312310
        GO TO 1510                                                      S0312320
C       BEGIN PARAMETER SECTION FOR AREA AND BUILDING EMISSIONS         S0312330
   1430 CONTINUE                                                        S0312340
C       CALCULATE EFFECTIVE SOURCE RADIUS                               S0312350
        RO = SQRT(S1*S2*.31830988)                                      S0312360
        XM = .5*SQRT(S1*S2)                                             S0312370
C       CALCULATE VIRTUAL DISTANCE DUE TO CROSSWIND SOURCE DIMENSION    S0312380
        XY = RO*E2                                                      S0312390
C       IS THIS A BUILDING EMISSION                                     S0312400
        IF (TYPE .EQ. 1) GO TO 1440                                     S0312410
C       NO - AREA                                                       S0312420
        C3 = 2.0*RO                                                     S0312430
        SQ = 6.0*RO                                                     S0312440
   1440 C6 = H*E1                                                       S0312450
        C2 = H                                                          S0312460
        IF (ISW(9) .EQ. 0) GO TO 1450                                   S0312470
        IF (C2 .LT. HMIN) C2 = HMIN                                     S0312480
        GO TO 1470                                                      S0312490
   1450 IF (C2+HS .GT. ZR+HA) GO TO 1460                                S0312500
        C2 = ZR                                                         S0312510
        GO TO 1470                                                      S0312520
   1460 C2 = C2+HS-HA                                                   S0312530
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 1470 C2 = C2*ZRI                                                       S0312340
      DO 1500 I=1,NSTBLE                                                S0312350
      DO 1500 J=1,NSPEED                                                S0312360
      UBH = UBAR(J)*C2**P(J,I)                                          S0312370
      IF (TYPE .EQ. 2) GO TO 1480                                       S0312380
      C7 = C6-RO*SIGEPL(J,I)                                            S0312390
      IF (C7 .LT. 0.0) C7 = 0.0                                         S0312500
      GO TO 1490                                                        S0312510
 1480 CONTINUE                                                          S0312520
      C3 = C3                                                           S0312530
      BZ = S1*S2/C3                                                     S0312540
      C7 = 1.0/(SIGEPL(J,I)*UBH*S1*S2)                                  S0312550
      HP(J,I,1) = SIGEPL(J,I)*C3                                        S0312560
 1490 UBH = 1.0/UBH                                                     S0312570
      DO 1500 K=1,NSEASN                                                S0312580
      UBHP(J,I,K) = UBH                                                 S0312590
      XZ(J,I,K) = C7                                                    S0312700
 1500 CONTINUE                                                          S0312710
C     END OF PLUME RISE AND SOURCE PARAMETER SECTION                    S0312720
 1510 CONTINUE                                                          S0312730
      HAHS = HA-HS                                                      S0312740
C                                                                       S0312750
C***********************************************************************S0312760
C     BEGIN CONCENTRATION MODEL CALCULATIONS                            S0312770
C                                                                       S0312780
C     BEGIN LOOP OVER Y GRID COORDINATES                                S0312790
      IF (NYPNTS .LE. 0) GO TO 1580                                     S0312900
      IKSW = 1                                                          S0312310
      JJ = 0                                                            S0312320
 1520 JJ = JJ+1                                                         S0312330
      IF (JJ .GT. NYPNTS) GO TO 1580                                    S0312940
      JJJ = (JJ-1)*NXPNTS                                               S0312350
      IF (ISW(13) .NE. 0) GO TO 1530                                    S0312360
      YP = Y(JJ)-DY                                                     S0312370
      GO TO 1540                                                        S0312380
 1530 CN1 = Y(JJ)*RADIAN                                                S0312390
      SN1 = SIN(CN1)                                                    S0312900
      CN1 = COS(CN1)                                                    S0312910
      1540 CONTINUE                                                    S0312920
C          BEGIN LOOP OVER X GRID COORDINATES                          S0312930
           II = 0                                                      S0312940
      1550 II = II+1                                                   S0312950
           IF (II .GT. NXPNTS) GO TO 1520                              S0312960
           IF (ISW(13) .NE. 0) GO TO 1560                              S0312970
           XP = X(II)-DX                                               S0312980
           GO TO 1570                                                  S0312990
      1560 XP = X(II)*SN1+UTMX-DX                                      S0313000
           YP = X(II)*CN1+UTMY-DY                                      S0313010
      1570 CONTINUE                                                    S0313020
           IJ = JJJ+II                                                 S0313030
           GO TO 1610                                                  S0313040
      1580 IKSW = 2                                                    S0313050
           IF (MXWYPT .LE. 0) GO TO 1980                               S0313060
           IJ = NXYPTS                                                 S0313070
      1590 IJ = IJ+1                                                   S0313080
           IF (IJ .GT. NXXYY) GO TO 1980                               S0313090
           JJ = NYX+IJ-NXYPTS                                          S0313100
           II = NXY+IJ-NXYPTS                                          S0313110
           IF (ISW(14) .NE. 0) GO TO 1600                              S0313120
           YP = Y(JJ)-DY                                               S0313130
           XP = X(II)-DX                                               S0313140
           GO TO 1610                                                  S0313150
      1600 CN1 = Y(JJ)*RADIAN                                          S0313160
           YP = X(II)*COS(CN1)-DY                                      S0313170
           XP = X(II)*SIN(CN1)-DX                                      S0313180
      1610 CONTINUE                                                    S0313190
           ZZ = Z(IJ)                                                  S0313200
           IF (NYS .GT. 0.OR.ISW(8) .EQ. 0) ZZ = 0.0                   S0313210
           DO 1620 K=1,NSEASN                                          S0313220
           IF (ICFLG(K) .EQ. 0) CON(IJ,K) = 0.0                        S0313230
      1620 CONTINUE                                                    S0313240
           IF (WS .LE. 0.0) GO TO 1970                                 S0313250
C          BEGIN LOOP OVER WIND DIRECTION SECTORS                      S0313260
           DO 1960 N=1,NSCTOR                                          S0313270
           JFLG = 0                                                    S0313280
C          CALCULATE DOWNWIND AND CROSSWIND DISTANCE FROM CENTER OF SOURCE S0313290
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C     TO THE GRID POINT                                                 S0313300
      XB = -XP*PHS(N)-YP*PHC(N)                                         S0313310
      YB =  XP*PHC(N)-YP*PHS(N)                                         S0313320
C     IS POINT DOWNWIND, OUT OF SOURCE BOUNDARY                         S0313330
      IF (XB .GT. RO) GO TO 1640                                        S0313340
C     IF TYPE IS ELEVATED GET OUT                                       S0313350
      IF (TYPE .EQ. 0) GO TO 1960                                       S0313360
C     AREA OR BUILDING                                                  S0313370
      R = SQRT(XB*XB+YB*YB)                                             S0313380
C     IS POINT WITHIN AREA OR BUILDING                                  S0313390
      IF (R .LE. RO) GO TO 1630                                         S0313400
      IF (XB .LE. 0.0) GO TO 1960                                       S0313410
      IF (ABS(YB) .GT. XM) GO TO 1960                                   S0313420
      IF (TYPE .EQ. 1) GO TO 1640                                       S0313430
      XB = RO+1.0                                                       S0313440
      GO TO 1640                                                        S0313450
 1630 IF (TYPE .EQ. 1) GO TO 1960                                       S0313460
C     DISTANCE FROM UPWIND EDGE OF AREA TO GRID POINT                   S0313470
      R = RO+XB                                                         S0313480
      IF (R .LE. 0.0) GO TO 1960                                        S0313490
      GO TO 1670                                                        S0313500
C     POINTS DOWNWIND OF SOURCE                                         S0313510
 1640 CONTINUE                                                          S0313520
C     DISTANCE DOWNWIND PLUS VIRTUAL DISTANCE                           S0313530
      XF = XB+XY                                                        S0313540
      F = XF*TNN                                                        S0313550
C     IF POINT OUTSIDE OF CALCULATION SECTOR GET OUT                    S0313560
      IF (ABS(YB) .GE. F) GO TO 1960                                    S0313570
C     DISTANCE FROM POINT SOURCE TO GRID POINT                          S0313580
      R = SQRT(XF*XF+YB*YB)                                             S0313590
 1650 F = TR*R                                                          S0313600
      C2 = XF/R                                                         S0313610
 1660 CONTINUE                                                          S0313620
C     CALCULATE SMOOTHING TERM                                          S0313630
      IF (C2 .GT. 1.0) C2 = 1.0                                         S0313640
      C2 = ABS(TR-ACOS(C2))/TR                                          S0313650
C     MULTIPLY ACCUMULATED PEAK CON BY SMOOTHING TERM OVER R*DELPHI     S0313660
      PP2 = PP1*C2/F                                                    S0313670
      GO TO 1680                                                        S0313680
C     POINT WITHIN AREA SOURCE                                          S0313690
 1670 PP2 = PP1                                                         S0313700
C     SET GRID POINT IN AREA SOURCE FLAG                                S0313710
      JFLG = 1                                                          S0313720
 1680 CONTINUE                                                          S0313730
C     START MAIN LOOP OVER STABILITY OR DAY/NIGHT                       S0313740
      DO 1950 I=1,NSTBLE                                                S0313750
      KK = 4*(I-1)                                                      S0313760
C     START MAIN LOOP OVER SPEED                                        S0313770
      DO 1950 J=1,NSPEED                                                S0313780
C     IS THIS AN AREA SOURCE AND POINT IS WITHIN                        S0313790
      IF (JFLG .EQ. 1) GO TO 1720                                       S0313800
C     IS THIS AN AREA SOURCE                                            S0313810
      IF (TYPE .EQ. 2) GO TO 1700                                       S0313820
C     IS THIS BUILDING EMISSION                                         S0313830
      IF (TYPE .EQ. 1) GO TO 1690                                       S0313840
C     PART OF SIGZ FOR ELEVATED SOURCES                                 S0313850
      FCT = SIGEPU(J,I)*R                                               S0313860
      GO TO 1730                                                        S0313870
C     PART OF SIGZ FOR BUILDING EMISSION SOURCES                        S0313880
 1690 FCT = SIGEPL(J,I)*R                                               S0313890
      GO TO 1730                                                        S0313900
C     PART OF SIGZ FOR AREA SOURCES                                     S0313910
 1700 IF (XB .GT. SO) GO TO 1710                                        S0313920
      FCT = HP(J,I,1)/ALOG((SIGEPL(J,I)*(XB+RO)+H)/(SIGEPL(J,I)*(XB-RO)+S0313930
     1H))                                                               S0313940
      GO TO 1730                                                        S0313950
 1710 FCT = SIGEPL(J,I)*XB+H                                            S0313960
      GO TO 1730                                                        S0313970
 1720 FCT = ALOG((SIGEPL(J,I)*(R+1.0)+H)/(SIGEPL(J,I)+H))*XZ(J,I,1)     S0313980
 1730 CONTINUE                                                          S0313990
C     START MAIN LOOP OVER SEASONS                                      S0314000
      DO 1940 K=1,NSEASN                                                S0314010
      IF (ICFLG(K) .EQ. 1) GO TO 1940                                   S0314020
      IF (QSS(J,I,K) .LE. 0.0) GO TO 1940                               S0314030
      QS1(K) = PP2*QSS(J,I,K)                                           S0314040
      KN = KK+K                                                         S0314050
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C     IS FREQUENCY OF OCCURRENCE ZERO - NO CALC                         S0314060
      IF (FREQ(J,N,KN) .LE. 0.0) GO TO 1940                             S0314070
C     IS POINT WITHIN AN AREA SOURCE                                    S0314080
      HMP = HM(J,I,K)                                                   S0314090
      IF (ZZ .LT. HA) HMP = HMP+(HA-ZZ)                                 S0314100
      IF (JFLG .EQ. 1) GO TO 1760                                       S0314110
      IF (TYPE .NE. 0) GO TO 1740                                       S0314120
C     IS PLUME HEIGHT GREATER THAN HM - NO CALC                         S0314130
      IF (HP(J,I,K) .GT. HM(J,I,K)+HAHS) GO TO 1940                     S0314140
 1740 IF (TYPE .NE. 1) GO TO 1750                                       S0314150
C     IS BUILDING HEIGHT GREATER THAN HM - NO CALC                      S0314160
      IF (H .GT. HM(J,I,K)+HAHS) GO TO 1940                             S0314170
 1750 SIGZ = FCT                                                        S0314180
      IF (TYPE .NE. 2) SIGZ = SIGZ+XZ(J,I,K)                            S0314190
      IF (SIGZ .LE. 0.0) GO TO 1940                                     S0314200
      SIGZ = 1.0/SIGZ                                                   S0314210
      PP4 = FREQ(J,N,KN)*(UBHP(J,I,K)*SIGZ)                             S0314220
      GO TO 1770                                                        S0314230
 1760 PP4 = FCT*FREQ(J,N,KN)                                            S0314240
      SIGZ = FCT*BZ/UBHP(J,I,K)                                         S0314250
      IF (SIGZ .LE. 0.0) GO TO 1940                                     S0314260
 1770 CONTINUE                                                          S0314270
      IF (ZZ .LE. HM(J,I,K)+HA) GO TO 1780                              S0314280
      IF (NPF1 .GT. 0) GO TO 1940                                       S0314290
      IQLT = IQLT+1                                                     S0314300
      IF (IQLT .GT. 51) GO TO 1940                                      S0314310
      CALL TITLR(ITC,1,2)                                               S0314320
      ITC = 1                                                           S0314330
      WRITE (JUNT,9037) NUMS9,K,I,J,X(II),Y(JJ)                         S0314340
      IF (IQLT .LT. 51) GO TO 1940                                      S0314350
      CALL TITLR(ITC,1,2)                                               S0314360
      WRITE (JUNT,9038)                                                 S0314370
      GO TO 1940                                                        S0314380
 1780 CONTINUE                                                          S0314390
C     CALCULATE VERTICAL TERM OF CONCENTRATION EQUATION                 S0314400
      V = 0.0                                                           S0314410
      SIGZI = -0.5*(SIGZ*SIGZ)                                          S0314420
      HPL = 0.0                                                         S0314430
      C      IF CONCENTRATION WITH DEPOSITION THEN BRANCH
             IF (NVS .GT. 0) GO TO 1870                                    S0314440
             IF (TYPE .GT. 1) GO TO 1820                                   S0314450
             IF (TYPE .EQ. 0) GO TO 1790                                   S0314460
      C      BUILDING SOURCES                                              S0314470
             HPL = H                                                       S0314480
             GO TO 1800                                                    S0314490
      C      ELEVATED SOURCES                                              S0314500
       1790 HPL = HP(J,I,K)                                                S0314510
       1800 HPL = HPL+HS-ZZ                                                S0314520
             IF (HPL .GT. 0.0) GO TO 1810                                  S0314530
             HPL = 0.0                                                     S0314540
             GO TO 1820                                                    S0314550
       1810 VLM = HPL*HPL*SIGZI                                            S0314560
             IF (VLM .LT. -30.0) GO TO 1830                                S0314570
             V = V+EXP(VLM)                                                S0314580
             GO TO 1830                                                    S0314590
       1820 V = V+1.0                                                      S0314600
       1830 RI = 0.0                                                       S0314610
       1840 RI = RI+2.0                                                    S0314620
             IF (RI .GT. 6.0) GO TO 1860                                   S0314630
             G1 = RI+HMP                                                   S0314640
             VLM = G1-HPL                                                  S0314650
             VLM = VLM*VLM*SIGZI                                           S0314660
             IF (VLM .LT. -10.0) GO TO 1910                                S0314670
             IF (TYPE .GT. 1) GO TO 1850                                   S0314680
             G1 = G1+HPL                                                   S0314690
             V = V+EXP(VLM)+EXP(G1*G1*SIGZI)                               S0314700
             GO TO 1840                                                    S0314710
       1850 V = V+2.0*EXP(VLM)                                             S0314720
             GO TO 1840                                                    S0314730
       1860 V = CNST/(SIGZ*HMP)                                            S0314740
             GO TO 1910                                                    S0314750
      C      CONCENTRATION WITH DEPOSITION                                 S0314760
       1870 XCT = R*UBHP(J,I.K)                                            S0314770
             IF (TYPE  .GT. 0) GO TO 1880                                  S0314780
             HPL = HP(J,I,K)                                               S0314790
             GO TO 1890                                                    S0314800
                                                                           S0314810
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 1880 HPL = H                                                    S0314820
      IF (TYPE .EQ. 2) HPL = 0.0                                 S0314830
 1890 CONTINUE                                                   S0314840
      IF (HPL .LT. 5.0) HPL = 5.0                                S0314850
      VLM = 2.0*HMP-HPL                                          S0314860
      DO 1900 LZ=1,NVS                                           S0314870
      RI = VS(LZ)+XCT                                            S0314880
      G1 = HPL-RI                                                S0314890
      RI = VLM+RI                                                S0314900
      G1 = G1*G1*SIGZI                                           S0314910
      RI = RI*RI*SIGZI                                           S0314920
      VV1 = 0.0                                                  S0314930
      VV2 = 0.0                                                  S0314940
      IF (G1 .GT. -30.0) VV1 = EXP(G1)                           S0314950
      IF (RI .GT. -30.0) VV2 = EXP(RI)                           S0314960
 1900 V = V+FRQ(LZ)*(VV1+VV2)                                    S0314970
      V = 0.5*V                                                  S0314980
 1910 PP4 = PP4*V                                                S0314990
C     ACCUMULATE CONCENTRATION                                   S0315000
 1920 PEAK = PP4*QSI(K)                                          S0315010
C     CALCULATE DECAY TERM                                       S0315020
      IF (DECAY .LE. 0.0) GO TO 1930                             S0315030
      RD = XB-RO                                                 S0315040
      VV1 = 0.0                                                  S0315050
      VV2 = -DECAY*RD*UBHP(J,I,K)                                S0315060
      IF (VV2 .GT. -30.0) VV1 = EXP(VV2)                         S0315070
      PEAK = PEAK*VV1                                            S0315080
 1930 CONTINUE                                                   S0315090
      CON(IJ,K) = CON(IJ,K)+PEAK                                 S0315100
C     END OF LOOP OVER SEASONS                                   S0315110
 1940 CONTINUE                                                   S0315120
C     END OF LOOP OVER STABILITY AND SPEED                       S0315130
 1950 CONTINUE                                                   S0315140
C     END OF SECTOR LOOP                                         S0315150
 1960 CONTINUE                                                   S0315160
 1970 CONTINUE                                                   S0315170
      GO TO (1550,1590),IKSW                                     S0315180
C     TOTAL CONCENTRATION FIELD CALCULATED-END OF X,Y LOOP       S0315190
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                                                                        S0315200
 1980 CONTINUE                                                          S0315210
C                                                                       S0315220
C     END CONCENTRATION CALCULATION SECTION                             S0315230
C                                                                       S0315240
C***********************************************************************S0315250
C     CONCENTRATION TAPE AND DISK OUTPUT                                S0315260
 1990 NPF1 = NPF1+1                                                     S0315270
      IF (ISW(2) .EQ. 0) GO TO 2010                                     S0315280
      DO 2000 K=1,NSEASN                                                S0315290
C     WRITE NXXYY CONCENTRATION VALUES FROM CON(1,K) TO TAPE BUFFER     S0315300
      CALL INPOUP(2,CON(1,K),NXXYY)                                     S0315310
      IF (NOGO .NE. 0) GO TO 2340                                       S0315320
 2000 CONTINUE                                                          S0315330
 2010 IF (IREPT .LT. 2) GO TO 820                                       S0315340
C     WRITE CONCENTRATION TO DISK FOR LATER REPORTS                     S0315350
      DO 2020 K=1,NSEASN                                                S0315360
      JOREC = JOREC+1                                                   S0315370
      INCMA = JOREC                                                     S0315380
C     WRITE MASS STORAGE LU 12, RECORD INCMA                            S0315390
 2020 WRITE (12'INCMA) (CON(I,K),I=1,NXXYY)                             S0315400
C     RETURN FOR NEXT SOURCE                                            S0315410
      GO TO 820                                                         S0315420
C     END OF INPUT DATA                                                 S0315430
 2030 CONTINUE                                                          S0315440
      IF (ISW(2) .EQ. 0) GO TO 2040                                     S0315450
      NUMSQ = 9999999                                                   S0315460
C     WRITE END RECORD TO OUTPUT BUFFER, LENREC WORDS, NUMSQ=9999999    S0315470
      CALL INPOUP(2,DMYSQ,LENREC)                                       S0315480
C     CLOSE OUTPUT TAPE FILE                                            S0315490
      CALL INPOUP(3,DMYSQ,LENREC)                                       S0315500
 2040 IF (IREPT .EQ. 0) GO TO 2300                                      S0315510
      II = NSEASN                                                       S0315520
      IF (IREPT .EQ. 1) II = 0                                          S0315530
      NREC = JOREC                                                      S0315540
      IF (ISW(2) .LT. 2) GO TO 2100                                     S0315550
C     PRODUCE OUTPUT TAPE SOURCE INVENTORY LISTING                      S0315560
      ITC = 0                                                           S0315570
      IB = II+1
      JOREC = -II                                                       S0315380
 2050 JOREC = JOREC+IB                                                  S0315390
      IF (JOREC .GT. NREC) GO TO 2100                                   S0315400
      INCMA = JOREC                                                     S0315410
C     READ MASS STORAGE LU 12, RECORD INCMA                             S0315420
      READ (12'INCMA) (SORC(I),I=1,LENREC)                              S0315430
      CALL TITLR(ITC,1,3)                                               S0315440
      IF (IPC .EQ. 0) GO TO 2060                                        S0315450
      ITC = 1                                                           S0315460
      K = 1                                                             S0315470
      IF (ISW(15) .NE. 0) K = 3                                         S0315480
      WRITE (JUNT,9025) IFMT(13),IFMT(14),LKNT,IFMT(9),IFMT(10),IFMT(15)S0315490
     1,IFMT(16),IFMT(11),IFMT(12),MUNT(K),MUNT(K+1)                     S0315500
      LINE = LINE+6                                                     S0315510
 2060 WRITE (JUNT,9029) DATE1,NUMSQ,TYPE,(QSS(1,1,L),L=1,4),DX,DY,H,HS, S0315520
     1 TS,VOL,RDS                                                       S0315530
      IF (NBX .EQ. 0) GO TO 2080                                        S0315540
      DO 2070 I=2,NSTBLE                                                S0315550
      DO 2070 J=1,NSPEED                                                S0315560
      CALL TITLR(1,1,3)                                                 S0315570
      IF (IPC .EQ. 0) GO TO 2070                                        S0315580
      WRITE (JUNT,9025) IFMT(13),IFMT(14),LKNT,IFMT(9),IFMT(10),IFMT(15)S0315590
     1,IFMT(16),IFMT(11),IFMT(12),MUNT(K),MUNT(K+1)                     S0315600
      LINE = LINE+6                                                     S0315610
 2070 WRITE (JUNT,9039) (QSS(J,I,L),L=1,4),J,I                          S0315620
 2080 CONTINUE                                                          S0315630
      IF (NVS .LE. 0) GO TO 2050                                        S0315640
      CALL TITLR(1,1,3)                                                 S0315650
      IF (IPC .EQ. 0) GO TO 2090                                        S0315660
      WRITE (JUNT,9025) IFMT(13),IFMT(14),LKNT,IFMT(9),IFMT(10),IFMT(15)S0315670
     1,IFMT(16),IFMT(11),IFMT(12),MUNT(K),MUNT(K+1)                     S0315680
      LINE = LINE+6                                                     S0315690
 2090 CONTINUE                                                          S0315700
      WRITE (JUNT,9031) NVS,(VS(I),FRQ(I),I=1,NVS)                      S0315710
      GO TO 2050                                                        S0315720
C     PRODUCE CONCENTRATION REPORTS                                     S0315730
 2100 IF (IREPT .EQ. 1) GO TO 2300                                      S0315740
      IF (NGROUP .LE. 0) GO TO 2300                                     S0315750
      R = 1.0/FLOAT(NSEASN)                                             S0315360
      L = 0                                                             S0315370
      M = 0                                                             S0315380
 2110 L = L+1                                                           S0315390
      IF (L .GT. NGROUP) GO TO 2300                                     S0316000
      DO 2120 K=1,NSEASN                                                S0316010
      DO 2120 J=1,NXXYY                                                 S0316020
 2120 CON(J,K) = 0.0                                                    S0316030
      NS = NSOGRP(L)                                                    S0316040
      N = 0                                                             S0316050
      IB = 0                                                            S0316060
 2130 N = N+1                                                           S0316070
      IF (N .GT. NS) GO TO 2240                                         S0316080
      M = M+1                                                           S0316090
      NM = IDSOR(M)                                                     S0316100
      IFLG = 0                                                          S0316110
      IB = IB+2                                                         S0316120
      IF (IB .GT. 200) IB = 200                                         S0316130
      IPRT(IB) = NM                                                     S0316140
      IPRT(IB-1) = IBLNK                                                S0316150
      IF (NM .GT. 0.AND.IB .GT. 2) IPRT(IB-1) = ICOM                    S0316160
      IF (NM .GT. 0) GO TO 2190                                         S0316170
      IF (NM .LT. 0) GO TO 2150                                         S0316180
 2140 IB = IB-2                                                         S0316190
      GO TO 2130                                                        S0316200
 2150 IF (N .GT. 1) GO TO 2160                                          S0316210
      NM = NSAVE-1                                                      S0316220
      IF (NM .LT. 0) NM = 0                                             S0316230
      IF (IB .EQ. 200) IB = 198                                         S0316240
      IPRT(IB+2) = IPRT(IB)                                             S0316250
      IPRT(IB+1) = IPRT(IB-1)                                           S0316260
      IPRT(IB) = NM+1                                                   S0316270
      IPRT(IB-1) = IBLNK                                                S0316280
      IB = IB+2                                                         S0316290
      IF (IB .GT. 200) IB = 200                                         S0316300
      GO TO 2170                                                        S0316310
 2160 NM = IDSOR(M-1)                                                   S0316320
 2170 II = IABS(IDSOR(M))                                               S0316330
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      IFLG = 1                                                          S0316340
 2180 NM = NM+1                                                         S0316350
      IF (NM .LE. II) GO TO 2190                                        S0316360
      GO TO 2130                                                        S0316370
 2190 I = 1                                                             S0316380
      IF (NM .LE. 7000) GO TO 2200                                      S0316390
      I = 2                                                             S0316400
      IF (NM .LE. 14000)) GO TO 2200                                    S0316410
      I = 3                                                             S0316420
 2200 CONTINUE                                                          S0316430
      J = MOD(NM,7000)                                                  S0316440
      IF (J .EQ. 0) J = 7000                                            S0316450
C     RETRIEVE RECORD NUMBER FROM IARRY                                 S0316460
      JJ = AND(IARRY(J),NLT(I))                                         S0316470
C     SHIFT RECORD NUMBER INTO LOW ORDER PART OF JJ, DEPENDING ON MLT(I)S0316480
      JJ = JJ/MLT(I)                                                    S0316490
      IF (JJ .GT. 0.AND.JJ .LT. NREC) GO TO 2210                        S0316500
      GO TO 2230                                                        S0316510
 2210 JOREC = JJ                                                        S0316520
      DO 2220 K=1,NSEASN                                                S0316530
      JOREC = JOREC+1                                                   S0316540
      INCMA = JOREC                                                     S0316550
C     READ MASS STORAGE LU 12, RECORD INCMA                             S0316560
      READ (12'INCMA) (CON(I,5),I=1,NXXYY)                              S0316570
      DO 2220 J=1,NXXYY                                                 S0316580
 2220 CON(J,K) = CON(J,K)+CON(J,5)                                      S0316590
 2230 IF (IFLG .EQ. 1) GO TO 2180                                       S0316600
      GO TO 2130                                                        S0316610
C     PRODUCE REPORT FOR SOURCE GROUP L                                 S0316620
 2240 CONTINUE                                                          S0316630
      IF (NSEASN .EQ. 1) GO TO 2290                                     S0316640
      IF (ISW(3) .EQ. 0) GO TO 2260                                     S0316650
C     PRODUCE SEASONAL CONCENTRATION LISTING                            S0316660
      KK = 1                                                            S0316670
      DO 2250 K=1,NSEASN                                                S0316680
      CALL OUTPT(KK,K,IB,NMS,IPRT,X,Y,CON(1,K))                         S0316690
 2250 CONTINUE                                                          S0316700
      IF (ISW(4) .EQ. 0) GO TO 2110                                     S0316710
 2260 DO 2270 K=2,NSEASN                                                S0316720
      DO 2270 J=1,NXXYY                                                 S0316730
 2270 CON(J,1) = CON(J,1)+CON(J,K)                                      S0316740
      DO 2280 J=1,NXXYY                                                 S0316750
 2280 CON(J,1) = CON(J,1)*R                                             S0316760
 2290 CONTINUE                                                          S0316770
C     PRODUCE ANNUAL CONCENTRATION LISTING                              S0316780
      KK = 3                                                            S0316790
      IF (NSEASN .EQ. 1.AND.ISW(4) .EQ. 0) KK = 1                       S0316800
      K = 1                                                             S0316810
      CALL OUTPT(KK,K,IB,HMS,IPRT,X,Y,CON)                              S0316820
C     RETURN FOR NEXT GROUP                                             S0316830
      GO TO 2110                                                        S0316840
C     END OF PROGRAM                                                    S0316850
 2300 CONTINUE                                                          S0316860
      GO TO 2350                                                        S0316870
 2310 IF (NOGO .EQ. 1) GO TO 2320                                       S0316880
      WRITE (JUNT,9032) IT1REC                                          S0316890
      GO TO 2330                                                        S0316900
 2320 WRITE (JUNT,9036) IT1REC                                          S0316910
 2330 IF (IT1REC .GT. 4) GO TO 1020                                     S0316920
      GO TO 2350                                                        S0316930
 2340 WRITE (JUNT,9033) IT2REC                                          S0316940
C     CLOSE OUTPUT TAPE FILE                                            S0316950
      CALL INPOUP(3,DMYSQ,LENREC)                                       S0316960
 2350 CONTINUE                                                          S0316970
      IF (JUNT .EQ. 6 .OR. JUNT .EQ. 56) GO TO 2360                     S0316980
      ENDFILE JUNT                                                      S0316990
      ENDFILE JUNT                                                      S0317000
      REWIND JUNT                                                       S0317010
 2360 CONTINUE                                                          S0317020
      RETURN                                                            S0317030
C                                                                       S0317040
C***********************************************************************S0317050
 9001 FORMAT (F7.0,F10.0,5F7.0,2F5.0,F11.0)                             S0317060
 9002 FORMAT (20A4)                                                     S0317070
 9003 FORMAT (13I6)                                                     S0317080
 9004 FORMAT (20I4)                                                     S0317090
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9005 FORMAT (8F10.0)                                                   S0317100
9006 FORMAT (10X,29HNUMBER OF SOURCE INPUT CARDS,25X,10H(NSOURC) =,I7/ S0317110
     110X,28HNUMBER OF X GRID COORDINATES,25X,10H(NXPNTS) =,I7/         S0317120
     210X,28HNUMBER OF Y GRID COORDINATES,25X,10H(NYPNTS) =,I7/         S0317130
     310X,39HNUMBER OF SEASONS (IF 1 ANNUAL ASSUMED),14X,10H(NSEASN) =,IS0317140
     47/10X,31HNUMBER OF WIND SPEED CATEGORIES,22X,10H(NSPEED) =,I7/    S0317150
     510X,30HNUMBER OF STABILITY CATEGORIES,23X,10H(NSTBLE) =,I7/       S0317160
     610X,44HNUMBER OF WIND DIRECTION (SECTOR) CATEGORIES,9X,10H(NSCTOR)S0317170
     7 =,I7/10X,63HNUMBER OF CONCENTRATION REPORTS (SOURCE COMBINATIONS)S0317180
     8(NGROUP) =,I7/10X,22HLAST TAPE INPUT SOURCE,31X,10H(NSTOP ) =,I8/1S0317190
     90X,29HNUMBER OF DISCRETE X,Y POINTS,24X,10H(NXWYPT) =,I6)         S0317200
9007 FORMAT (10X,42HIS TAPE INPUT USED (0 IS NO, NOT 0 IS YES),11X,10H(S0317210
     1ISW(1)) =,I2/10X,19HIS TAPE OUTPUT USED,34X,10H(ISW(2)) =,I2/     S0317220
     210X,48HIS OUTPUT TAPE SOURCE INVENTORY LISTING PRODUCED,5X,10H(ISWS0317230
     3(2)) =,I2/10X,45HARE CONCENTRATION REPORTS ON A SEASONAL BASIS,8X,S0317240
     410H(ISW(3)) =,I2/10X,44HARE CONCENTRATION REPORTS ON AN ANNUAL BASS0317250
     5IS,9X,10H(ISW(4)) =,I2/10X,63HIS AN INPUT CARD SOURCE INVENTORY LIS0317260
     6STING PRODUCED   (ISW(6)) =,I2/10X,63HIS AN INPUT TAPE SOURCE INVES0317270
     7NTORY LISTING PRODUCED   (ISW(7)) =,I2/10X,25HARE TERRAIN HEIGHTS S0317280
     8INPUT,29X,10H(ISW(8)) =,I2/10X,25HIS UBAR TERRAIN FOLLOWING,23X,10S0317290
     9H(ISW(9)) =,I2)                                                   S0317300
9008 FORMAT (10X,38HCONCENTRATION UNITS CONVERSION FACTOR,23X,2H =,    S0317310
     1                      E15.9/10X,43HACCELERATION OF GRAVITY (G METES0317320
     2RS/SEC**2) =,F9.4/10X,49HHEIGHT OF MEASUREMENT OF WIND SPEED (ZR MS0317330
     3ETERS) =,F7.3/10X,59HENTRAINMENT PARAMETER FOR AN UNSTABLE ATMOSPHS0317340
     4ERE (GAMMA1) =,F5.3/10X,56HENTRAINMENT PARAMETER FOR A STABLE ATMOS0317350
     5SPHERE (GAMMA2) =,F5.3/10X,70HANGULAR DISPLACEMENT OF GRID SYSTEM S0317360
     6FROM TRUE NORTH (ROTATE DEGREES) =,F8.3/10X,17HDECAY COEFFICIENT, S0317370
     75X,9H(DECAY) =,E14.9/10X,41HELEVATION OF WEATHER STATION (HA METERS0317380
     8S =,F9.2/10X,45HX ORIGIN OF POLAR COORDINATES (UTMX METERS) =,F10.S0317390
     92/10X,45HY ORIGIN OF POLAR COORDINATES (UTMY METERS) =,F10.2)     S0317400
9009 FORMAT (1H0,19X,41H*-* COORDINATE SYSTEM X AXIS (METERS) *-*//(8(1S0317410
     1X,E14.8,1H,)))                                                    S0317420
9010 FORMAT (1H0,19X,30H*-* COORDINATE SYSTEM Y AXIS (,A4,A3,4H)*-*//(8S0317430
     1(1X,E14.8,1H,)))                                                  S0317440
9011 FORMAT (1H0,25X,51H*-* AMBIENT AIR TEMPERATURE (TA DEGREES KELVIN)S0317450
     1 *-*//20X,6(11HSTABILITY  )/20X,6(08HCATEGORY,I2,1X))             S0317460
9012 FORMAT (10X,6HSEASON,I3,6F11.4)                                   S0317470
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 9013 FORMAT (1H0,34X,38H*-* MIXING LAYER DEPTH (HM METERS) *-*/)       S0317480
 9014 FORMAT (50X,6HSEASON,I2/21X,6(12H  WIND SPEED)/21X,6(10H  CATEGORYS0317490
     1,I2))                                                             S0317500
 9015 FORMAT (1X,18HSTABILITY CATEGORY,I2,6E12.6)                       S0317510
 9016 FORMAT (1H0,18X,70H*-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRES0317520
     1CTION AND STABILITY *-*)                                          S0317530
 9017 FORMAT (1H0,47X,6HSEASON,I2)                                      S0317540
 9018 FORMAT (1H0,41X,18HSTABILITY CATEGORY,I2/ 20X,6(12H  WIND SPEED)/2S0317550
     10X,6(10H  CATEGORY,I2)/8X,13HDIRECTION    ,6(1H(,F7.4,4HMPS))/7X,1S0317560
     23H(PHI DEGREES))                                                  S0317570
 9019 FORMAT (10X,F7.3,3X,6(F12.8))                                     S0317580
 9020 FORMAT (1H0,4X,108H*-* STANDARD DEVIATION OF THE WIND ELEVATION ANS0317590
     1GLE FOR ELEVATED POINT OR VOLUME SOURCES (SIGEPU RADIANS) *-*/)   S0317600
 9021 FORMAT(21X,6(12H  WIND SPEED)/21X,6(10H  CATEGORY,I2))            S0317610
 9022 FORMAT (1H0,04X,110H*-* STANDARD DEVIATION OF THE WIND ELEVATION AS0317620
     1NGLE FOR AREA OR BUILDING EMISSIONS SOURCES (SIGEPL RADIANS) *-*/)S0317630
 9023 FORMAT (1H0,19X,69H*-* VERTICAL POTENTIAL TEMPERATURE GRADIENT (DPS0317640
     1DZ DEGREES KELVIN) *-*/)                                          S0317650
 9024 FORMAT (1H0,34X,43H*-* WIND PROFILE POWER LAW EXPONENT (P) *-*/)  S0317660
 9025 FORMAT (1X,A4,A2,8HSOURCE T,6X,15HSOURCE EMISSION,3A4,         12XS0317670
     1,1HX,10X,1HY,6X,52HHEIGHT ELEVATION   IF TYPE=0     IF TYPE=0     S0317680
     2STACK/1X,A4,A2,8HNUMBER Y,63X,54HABOVE      AT        TEMP (DEG K)  VS0317690
     3OL. EMISS.   INTERNAL/1X,A4,A2,7X,1HP,116H SEASON 1  SEASON 2  SEAS0317700
     4SON 3  SEASON 4 COORDINATE COORDINATE  GROUND   BASE       IF TYPE=S0317710
     510R2 RT. M**3/SEC   RADIUS/1X,A4,A2,7X,11HE OR ANNUAL,31X,12H(METES0317720
     6RS)   (,A4,A2,56H)  (METERS) (METERS)  LENGTH SHORT   IF TYPE=1OR2S0317730
     7  (MTR)/96X,25HSIDE (METERS) LENGTH LONG/110X,11HSIDE (MTRS))     S0317740
 9026 FORMAT (1X,1HX,2X,I2,I7,I2,4F10.3,F10.2,F11.2,F8.2,F9.2,4X,F11.3,3S0317750
     1X,F11.3,2X,F7.2)                                                  S0317760
 9027 FORMAT (3X,1HX,2X,I7,I2,4F10.3,F10.2,F11.2,F8.2,F9.2,4X,F11.3,3X,FS0317770
     111.3,2X,F7.2)                                                     S0317780
 9028 FORMAT (24H ***WARNING-TAPE SOURCE ,I6,45H NOT FOUND - INPUT CARD S0317790
     1SOURCE IGNORED, DISP=,I2)                                         S0317800
 9029 FORMAT (1X,A4,A2,I6,I2,4F10.3,F10.2,F11.2,F8.2,F9.2,4X,F11.3,3X,F1S0317810
     11.3,2X,F7.2)                                                      S0317820
 9030 FORMAT (18H0-END-FILE, RECORD,I9,11H INPUT TAPE/)                 S0317830
 9031 FORMAT (16X,27HNUMBER PARTICLE CATEGORIES=,I3,28H - DISTRIBUTION (S0317840
     1VS1,FR91) =,2(2H (,E11.5,1H,,E11.5,1H))/(16X,4(2H (,E11.5,1H,,E11.S0317850
      25,1H))))                                                         S0317960
 9032 FORMAT (26H** ERROR INPUT TAPE RECORD,I8/)                        S0317970
 9033 FORMAT (27H** ERROR OUTPUT TAPE RECORD,I8/)                       S0317380
 9034 FORMAT (1H0,19X,43H*-* COORDINATES OF DISCRETE POINTS (METERS,,A4,S0317390
     1A3,4H)*-*//(8H (X,Y) =,5(2H (,F9.1,1H,,F10.1,2H),)))              S0317300
 9035 FORMAT (50H ** WARNING-FREQUENCY DIST IS NOT = 1.0 FOR SEASON,I2,2S0317310
     18H PROG NORMALIZES BY FACTOR =,E14.7)                             S0317320
 9036 FORMAT(34H0* END-OF-FILE ON UNIT 1 AT RECORD,I9/)                 S0317330
 9037 FORMAT (26H * WARNING Z>HM+HA, SOURCE,I5,9H, SEASON,I2,11H, STABILS0317340
     1ITY,I2,7H, SPEED,I2,4H, X=,F9.1,4H, Y=,F9.1)                      S0317350
 9038 FORMAT (51H TOO MANY WARNING MESSAGES PROG STOPS PRINTING THEM)   S0317360
 9039 FORMAT (15X,4F10.3,15H SPEED CATEGORY,I2,20H, STABILITY CATEGORY,IS0317370
     12)                                                                S0317380
 9040 FORMAT (10X,36HTOTAL NUMBER OF SOURCES IN INVENTORY,26X,1H=,I6)   S0317390
 9041 FORMAT (10X,43HIS THE FORMAT FOR FREQ (CARD GROUP 3A) READ,10X,10HS0318000
     1(ISW(11))=,I2/10X,53HIS THE FORMAT FOR SOURCE CARDS (CARD GROUP 1BS0318010
     2A) READ ,10H(ISW(12))=,I2/10X,53HGRID SYSTEM IS IN CARTESIAN (=0) S0318020
     3OR POLAR (=1) COORDS,10H(ISW(13))=,I2/10X,53HDISCRETE POINTS ARE CS0318030
     4ARTESIAN (=0) OR POLAR (=1)      ,10H(ISW(14))=,I2/10X,53HSOURCE COS0318040
     5ORDINATES ARE CARTESIAN (=0) OR POLAR (=1)  ,10H(ISW(15))=,I2/10X,S0318050
     646HSIGEPU OPTION FOR STACK, BUILDING, AREA SOURCES,7X,10H(ISW(16))S0318060
     7=,I2/10X,37HRURAL/URBAN MODE (RURAL=0), (URBAN=1),15X,10H(ISW(17))S0318070
     8=,I2)                                                             S0318080
 9042 FORMAT (53H ** WARNING SIGEPU  FOR SPEED AND STABILITY CATEGORY ,IS0318090
     11,5H AND ,I1,29H IS ZERO, NO DEFAULT PROVIDED)                    S0318100
 9043 FORMAT (53H ** WARNING SIGEPL  FOR SPEED AND STABILITY CATEGORY ,IS0318110
     11,5H AND ,I1,29H IS ZERO, NO DEFAULT PROVIDED)                    S0318120
 9044 FORMAT (89H ** WARNING - COMPLEX TERRAIN SWITCH SET WITH DEPOSITIOS0318130
     1N (NVS1), COMPLEX TERRAIN IGNORED)                                S0318140
 9045 FORMAT (77H ** ERROR - USING COMPLEX TERRAIN WITH DEPOSITION (NVS1S0318150
     1) AND NOT FIRST SOURCE)                                           S0318160
      END                                                               S0318170
      SUBROUTINE OUTPT(KK,K,IB,NMS,IPRT,X,Y,CON)                        S0400000
C                                                                       S0400010
      INTEGER TITLE                                                     S0400020
C                                                                       S0400030
      DIMENSION NMS(1),IPRT(1),X(1),Y(1),CON(1)                         S0400040
C                                                                       S0400050
      COMMON /DIM/ NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,NSCTOR,    S0400060
     1NXWYPT,TITLE(20),LUNT(6),LKNT(3),NSORY,ISW(20),IOVRSN,NGROUP,NSTOPS0400070
     2,NSORX                                                            S0400080
      COMMON /RST/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0400090
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),NLINES   S0400100
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,DATS(2),IUNT,JUNT,IBLNK            S0400110
C                                                                       S0400120
      EQUIVALENCE (PHC(1),LX),(PHC(2),LY),(PHC(3),J4),(PHC(4),I1),(PHC(5S0400130
     1),I2),(PHC(6),J3)                                                 S0400140
C                                                                       S0400150
C     THIS SUBROUTINE PRINTS THE SEASONAL/ANNUAL GROUND LEVEL           S0400160
C     CONCENTRATION.                                                    S0400170
C                                                                       S0400180
      INT = 1                                                           S0400190
      IF (KK .EQ. 99) LINE = NLINES                                     S0400200
      KKS = 0                                                           S0400210
      IF (KK .NE. 1) KKS = 3                                            S0400220
      IF (KK .EQ. 99) GO TO 10                                          S0400230
      INT = 0                                                           S0400240
      XBL = FLOAT(IB-5)/14.0                                            S0400250
      IF (XBL .LT. 0.0) XBL = 0.0                                       S0400260
      IBL = XBL                                                         S0400270
      IF (XBL .GT. FLOAT(IBL)) IBL = IBL+1                              S0400280
   10 ITC = 0                                                           S0400290
      IF (KK .EQ. 99) ITC = 1                                           S0400300
      IF (NXPNTS .LE. 0) GO TO 150                                      S0400310
      IF (KK .EQ. 99) GO TO 30                                          S0400320
      CMAX = -1.0                                                       S0400330
      DO 20 J=1,NYPNTS                                                  S0400340
      I2 = (J-1)*NXPNTS                                                 S0400350
      DO 20 I=1,NXPNTS                                                  S0400360
      IF (CON(I+I2) .LE. CMAX) GO TO 20                                 S0400370
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          CMAX = CON(I+I2)                                              S0400380
          XMAX = X(I)                                                   S0400390
          YMAX = Y(J)                                                   S0400400
   20 CONTINUE                                                          S0400410
C         PRINT 9 X AXIS POINTS ACROSS PAGE                             S0400420
   30 CONTINUE                                                          S0400430
          L = 1                                                         S0400440
          IF (ISW(13) .NE. 0) L = 3                                     S0400450
          IF (INT .NE. 1) INT = 4                                       S0400460
          J = 0                                                         S0400470
          I2 = 0                                                        S0400480
   40 I1 = I2+1                                                         S0400490
          IF (I1 .GT. NXPNTS) GO TO 150                                 S0400500
          I2 = I1+8                                                     S0400510
          IF (I2 .GT. NXPNTS) I2 = NXPNTS                               S0400520
          J3 = NYPNTS+1                                                 S0400530
   50 J3 = J3-1                                                         S0400540
          IF (J3 .EQ. 0) GO TO 130                                      S0400550
          IF (J .NE. 0) GO TO 80                                        S0400560
          CALL TITLR(ITC,1,INT)                                         S0400570
          ITC = 1                                                       S0400580
          IF (IPC .EQ. 0) GO TO 120                                     S0400590
   60 IF (KK .EQ. 99) GO TO 70                                          S0400600
          WRITE (JUNT,9001) (NMS(KKS+I),I=1,3),LUNT,(IPRT(I),I=1,IB)    S0400610
          LINE = LINE+IBL+1                                             S0400620
          IF (KK .NE. 1) GO TO 90                                       S0400630
          WRITE (JUNT,9002) K                                           S0400640
          LINE = LINE+1                                                 S0400650
          GO TO 90                                                      S0400660
   70 WRITE (JUNT,9008)                                                 S0400670
          LINE = LINE+2                                                 S0400680
          GO TO 100                                                     S0400690
   80 WRITE (JUNT,9011)                                                 S0400700
          LINE = LINE+2                                                 S0400710
          J = 0                                                         S0400720
          IF (KK .EQ. 99) GO TO 100                                     S0400730
   90 WRITE (JUNT,9012) CMAX,XMAX,YMAX,(X(I),I=I1,I2)                   S0400740
          LINE = LINE+3                                                 S0400750
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      WRITE (JUNT,9005) MUNT(L),MUNT(L+1)                                S0400760
      GO TO 110                                                          S0400770
  100 WRITE (JUNT,9003) (X(I),I=I1,I2)                                   S0400780
      LINE = LINE+2                                                      S0400790
      WRITE (JUNT,9009) MUNT(L),MUNT(L+1)                                S0400800
  110 LINE = LINE+3                                                      S0400910
  120 JS = (J3-1)*NXPNTS                                                 S0400920
      WRITE (JUNT,9004) Y(J3),(CON(JS+I),I=I1,I2)                        S0400330
      GO TO 50                                                           S0400340
  130 IF (12+LINE .LE. NLINES) GO TO 140                                 S0400350
      LINE = NLINES                                                      S0400360
      GO TO 40                                                           S0400370
  140 J = 1                                                              S0400380
      LINE = LINE+1                                                      S0400390
      GO TO 40                                                           S0400900
  150 IF (NXWYPT .EQ. 0) GO TO 260                                       S0400910
      J3 = NXPNTS*NYPNTS                                                 S0400920
      NIJ = NXPNTS+NYPNTS                                                S0400930
      NJI = NYPNTS+NXWYPT                                                S0400940
      IF (KK .EQ. 99) GO TO 170                                          S0400950
      CMAX = -1.0                                                        S0400960
      I2 = NXPNTS*NYPNTS                                                 S0400970
      DO 160 I=1,NXWYPT                                                  S0400980
      IF (CON(I+I2) .LE. CMAX) GO TO 160                                 S0400990
      CMAX = CON(I+I2)                                                   S0401000
      XMAX = X(NIJ+I)                                                    S0401010
      YMAX = Y(NJI+I)                                                    S0401020
  160 CONTINUE                                                           S0401030
  170 CONTINUE                                                           S0401040
      L = 1                                                              S0401050
      IF (ISW(14) .NE. 0) L = 3                                          S0401060
      XBL = FLOAT(NXWYPT)/3.0                                            S0401070
      IBL = XBL                                                          S0401080
      IF (XBL .GT. FLOAT(IBL)) IBL = IBL+1                               S0401090
      I = -2                                                             S0401100
      IF (INT .NE. 1) INT = 4                                            S0401110
      IF (NXPNTS .GT. 0) GO TO 190                                       S0401120
  180 LINE = NLINES                                                      S0401130
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      GO TO 200                                                         S0401140
  190 IF (LINE+9+IBL .GT. NLINES) GO TO 180                             S0401150
      WRITE (JUNT,9011)                                                 S0401160
      LINE = LINE+2                                                     S0401170
      IF (KK .EQ. 99) GO TO 230                                         S0401180
      GO TO 210                                                         S0401190
  200 I = I+3                                                           S0401200
      IF (I .GT. NXWYPT) GO TO 260                                      S0401210
      J4 = I+2                                                          S0401220
      IF (J4 .GT. NXWYPT) J4 = NXWYPT                                   S0401230
      CALL TITLR(ITC,1,INT)                                             S0401240
      ITC = 1                                                           S0401250
      I2 = 1                                                            S0401260
      IF (IPC .EQ. 0) GO TO 250                                         S0401270
      IF (KK .EQ. 99) GO TO 230                                         S0401280
      WRITE (JUNT,9001) (NMS(KKS+J),J=1,3),LUNT,(IPRT(J),J=1,IB)        S0401290
      LINE = LINE+IBL+1                                                 S0401300
  210 IF (KK .NE. 1) GO TO 220                                          S0401310
      WRITE (JUNT,9002) K                                               S0401320
      LINE = LINE+1                                                     S0401330
  220 WRITE (JUNT,9006) CMAX,XMAX,YMAX                                  S0401340
      GO TO 240                                                         S0401350
  230 WRITE (JUNT,9010)                                                 S0401360
  240 LINE = LINE+5                                                     S0401370
      IF (I .LT. 0) GO TO 200                                           S0401380
  250 WRITE (JUNT,9007) (X(NIJ+J),Y(NJI+J),CON(J3+J),J=I,J4)            S0401390
      GO TO 200                                                         S0401400
  260 CONTINUE                                                          S0401410
      RETURN                                                            S0401420
 9001 FORMAT (7X,3A4,29H GROUND LEVEL CONCENTRATION ,6A4,16H DUE TO SOURS0401430
     1CES ,6(A1,I6)/(1X,18(A1,I6)))                                     S0401440
 9002 FORMAT (60X,7HSEASON ,I2)                                         S0401450
 9003 FORMAT (60X,19H- X AXIS (METERS) -/14X,9F13.3)                    S0401460
 9004 FORMAT (1X,F13.3,1X,9F13.7)                                       S0401470
 9005 FORMAT (1X,9HY AXIS (,A4,A3,1H),43X,19H-  CONCENTRATION  -/14X,29(S0401480
     14H----)/)                                                         S0401490
 9006 FORMAT (50X,32H+-* DISCRETE POINT RECEPTORS +-+/30X,30H(THE MAXIMUS0401500
     1M CONCENTRATION IS ,F13.7,6H AT X=,F9.1,4H, Y=,F9.1,1H)/1X,3(4X,1HS0401510
     2X,9X,1HY,6X,13HCONCENTRATION,6X)/14X,58(2H--)/)                  S0401520
9007 FORMAT (3(1X,F9.1,F11.1,F14.7,5X))                                 S0401530
9008 FORMAT (     44X,44H*-* GRID SYSTEM TERRAIN HEIGHTS (METERS) *-*/) S0401540
9009 FORMAT (1X,8HY AXIS (,A4,A3,1H),44X,11H- HEIGHTS -/14X,29(4H----)/S0401550
     1)                                                                 S0401560
9010 FORMAT (40X,51H*-* TERRAIN HEIGHTS AT DISCRETE POINTS (METERS) *-*S0401570
     1//1X,3(4X,1HX,9X,1HY,9X,6HHEIGHT,10X)/14X,58(2H--)/)             S0401580
9011 FORMAT (/)                                                         S0401590
9012 FORMAT (50X,31H- GRID SYSTEM X AXIS (METERS) -/30X,30H(THE MAXIMUMS0401600
     1 CONCENTRATION IS ,F13.7,6H AT X=,F9.1,4H, Y=,F9.1,1H)/14X,9F13.3)S0401610
      END                                                               S0401620
      SUBROUTINE INPOUP(I,ADR1,ADR2)                                    S0500000
C                                                                       S0500010
      INTEGER TITLE,ADR2                                                S0500020
C                                                                       S0500030
      DIMENSION XEND(14),IXEND(14),ADR1(1),BUFIN(2000),BUFOT(2000,2)    S0500040
C                                                                       S0500050
      COMMON /DIM/ NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,NSCTOR,    S0500060
     1NKWYPT,TITLE(20),LUNT(6),LKNT(3),NSORY,ISW(20),IOVRSN,NGROUP,NSTOPS0500070
     2,NSORX                                                            S0500080
      COMMON /RST/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0500090
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),NLINES   S0500100
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,DATS(2),IUNT,JUNT,IBLNK            S0500110
      COMMON /IO/ NOGO,IT1REC,IT2REC,NINTP,NOTTP,NINFL(3),NOTFL(3)      S0500120
C                                                                       S0500130
      EQUIVALENCE (XEND,IXEND),(JOVRSN,XOVRSN),(XVSN,IVSN)              S0500140
C                                                                       S0500150
C$$$$                                                                   S0500160
C     IXEND (XEND) ASSUMES A 36 BIT WORD                                S0500170
C     IXEND IS A UNIVAC END OF TAPE SENTINEL RECORD                     S0500180
      DATA IXEND/0541600000000,13*0/,NI,NO,ISREC/3*1/,IT1REC,IT2REC,NOB,S0500190
     1IEND,LSW,IWRD/6*0/,NIB,NWRD/2*2000/,XFT/0.0/                      S0500200
C$$$$                                                                   S0500210
C     CURRENT VERSION OF ROUTINE INPOUP + 9900                          S0500220
      DATA JOVRSN/9903/                                                 S0500230
C                                                                       S0500240
C     I/O VERSION 1 OF THIS ROUTINE WAS UNBLOCKED RECORDS AND IS TURNED S0500250
C     ON BY SETTING LSW=1. I/O VERSION 2 WAS THE UNIVAC @FOR FORTRAN    S0500260
C     COMPILER. I/O VERSION 3 IS THE UNIVAC @FTN FORTRAN COMPILER.      S0500270
C                                                                       S0500280
      NOGO = 0                                                          S0500290
      IF (I .EQ. 2) GO TO 240                                           S0500300
      IF (I .EQ. 3) GO TO 390                                           S0500310
      IF (LSW .EQ. 0) GO TO 30                                          S0500320
      IT1REC = IT1REC+1                                                 S0500330
C     READ TAPE NINFL(NI)- 22=CLEAR UNIT, 2=READ, ADR1=INPUT BUFFER,    S0500340
C     ADR2=NO. OF WORDS IN BUFFER, IEOF=RETURNED I/O STATUS             S0500350
C     IEOF=-1 TRANSMISSION NOT COMPLETE, -2=EOT, -3 OR -4=ERROR,        S0500360
C     0=EOF, >0=NUMBER OF WORDS READ.                                   S0500370
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```
      CALL NTRAN$(NINFL(NI),22,2,ADR2,ADR1,IEOF)                        S0500380
   10 IF (IEOF .GT. 0) GO TO 20                                         S0500390
      IF (IEOF .EQ. -1) GO TO 10                                        S0500400
      IF (IEOF .EQ. -2) GO TO 220                                       S0500410
      GO TO 230                                                         S0500420
   20 IF (ADR2 .NE. 197) GO TO 410                                      S0500430
      ADR1(197) = ADR1(196)                                             S0500440
      ADR1(196) = ADR1(195)                                             S0500450
      ADR1(195) = ADR1(194)                                             S0500460
      K = 1                                                             S0500470
C     CONVERT FIELDATA CHARACTERS TO ASCII, K WORDS                     S0500480
      CALL FFDASC(K,ADR1(195),ADR1(194))                                S0500490
      GO TO 410                                                         S0500500
   30 N = 0                                                             S0500510
   40 N = N+1                                                           S0500520
      IF (N .GT. ADR2) GO TO 410                                        S0500530
   50 NIB = NIB+1                                                       S0500540
      IF (NIB .GT. IWRD) GO TO 120                                      S0500550
      ADR1(N) = BUFIN(NIB)                                              S0500560
C     CHECK WHICH VERSION WROTE TAPE, VERSION 9902 (@FOR) OR 9903 (@FTN)S0500570
      IF (I .GT. 0) GO TO 40                                            S0500580
      IF (ADR2 .NE. 58) GO TO 100                                       S0500590
      IF (N .LT. 58) GO TO 40                                           S0500600
      GO TO 70                                                          S0500610
   60 ADR1(37) = ADR1(24)                                               S0500620
   70 CONTINUE                                                          S0500630
      XVSN = ADR1(N)                                                    S0500640
      IF (ADR1(N) .EQ. XOVRSN) GO TO 40                                 S0500650
      IVSN = 9902                                                       S0500660
      NIB = NIB-14                                                      S0500670
      IF (LSW .EQ. 1) NIB = NIB-20                                      S0500680
C     CONVERT FIELDATA CHARACTERS TO ASCII, K WORDS                     S0500690
      K = 2                                                             S0500700
      CALL FFDASC(K,TITLE(15),LKNT(1))                                  S0500710
      K = 4                                                             S0500720
      CALL FFDASC(K,TITLE(11),LUNT(1))                                  S0500730
      DO 80 K=1,10                                                      S0500740
   80 TITLE(21-K) = TITLE(11-K)                                         S0500750
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```
      K = 10
C     CONVERT FIELDATA CHARACTERS TO ASCII. 10 WORDS (OLD TO NEW FORMAT)S0500760
      CALL FFDASC(K,TITLE(11),TITLE(1))                                 S0500770
      DO 90 K=16,20                                                     S0500780
   90 TITLE(K) = IBLNK                                                  S0500790
      IOVRSN = JOVRSN                                                   S0500800
      IF (LSW .EQ. 1) GO TO 410                                         S0500810
      GO TO 40                                                          S0500820
  100 IF (IVSN .EQ. JOVRSN) GO TO 40                                    S0500830
      IF (ADR2 .NE. 197.OR.N .LT. 197) GO TO 40                         S0500840
      NIB = NIB-1                                                       S0500850
C     SHIFT LAST 3 WORDS AND CONVERT FIELDATA DATE TO ASCII             S0500860
      DO 110 K=1,3                                                      S0500870
  110 ADR1(198-K) = ADR1(197-K)                                         S0500880
      K = 1                                                             S0500890
      CALL FFDASC(K,ADR1(195),ADR1(194))                                S0500900
      GO TO 40                                                          S0500910
  120 JSW = 1                                                           S0500920
      IEND = 0                                                          S0500930
      IT1REC = IT1REC+1                                                 S0500940
      NIB = 0                                                           S0500950
C     READ TAPE NINFL(NI)                                               S0500960
  130 CALL NTRAN$(NINFL(NI),22,2,NWRD,BUFIN,IEOF)                       S0500970
  140 IF (IEOF .GT. 0) GO TO 170                                        S0500980
      IF (IEOF .EQ. -1) GO TO 140                                       S0500990
      IF (IEOF .EQ. -2) GO TO 150                                       S0501000
      IF (JSW .EQ. 2) GO TO 190                                         S0501010
      IF (IEND .EQ. 1) GO TO 200                                        S0501020
C     READ ERROR                                                        S0501030
      WRITE (JUNT,9001) NINFL(NI),IT1REC                                S0501040
      LINE = 200                                                        S0501050
      GO TO 230                                                         S0501060
  150 IF (JSW .EQ. 2) GO TO 190                                         S0501070
      IEND = IEND+1                                                     S0501080
      IF (IEND .GT. 1) GO TO 160                                        S0501090
      IT1REC = IT1REC-1                                                 S0501100
      IF (IT1REC .LE. 0) GO TO 120                                      S0501110
      GO TO 130                                                         S0501120
                                                                        S0501130
  160 WRITE (JUNT,9002) NINFL(NI),IT1REC                                S0501140
      LINE = 200                                                        S0501150
      GO TO 220                                                         S0501160
  170 IWRD = IEOF                                                       S0501170
      IF (IT1REC .GT. 1) GO TO 180                                      S0501180
      IF (IEOF .NE. NWRD) LSW = 1                                       S0501190
  180 IF (JSW .EQ. 2) GO TO 200                                         S0501200
      IF (IEND .EQ. 0) GO TO 50                                         S0501210
C     CHECK FOR END OF REEL SENTINEL FOR MULTIPLE REEL FILE             S0501220
      IF (BUFIN(1) .NE. XEND(1)) GO TO 200                              S0501230
      IF (IEOF .NE. 14) GO TO 200                                       S0501240
      JSW = 2                                                           S0501250
      GO TO 130                                                         S0501260
C     END MULTIPLE REEL FILE, 11=REWIND AND INTERLOCK FILE, 22=CLEAR I/OS0501270
  190 CALL NTRAN$(NINFL(NI),22,11,22,22,22)                             S0501280
      NI = NI+1                                                         S0501290
      IF (NI .GT. NINTP) GO TO 210                                      S0501300
      GO TO 120                                                         S0501310
  200 WRITE (JUNT,9003) NINFL(NI),IT1REC                                S0501320
      LINE = LINE+2                                                     S0501330
C     POSITION TAPE NINFL(NI) BY BLOCKS. 22=CLEAR I/O, 7=MOVE BLOCKS,   S0501340
C     -1=BACK 1 BLOCK                                                   S0501350
      CALL NTRAN$(NINFL(NI),22,7,-1,22,22)                              S0501360
      GO TO 220                                                         S0501370
  210 WRITE (JUNT,9004)                                                 S0501380
      LINE = LINE+2                                                     S0501390
      NI = 1                                                            S0501400
      GO TO 120                                                         S0501410
  220 NOGO = 1                                                          S0501420
      IT1REC = 0                                                        S0501430
      LSW = 0                                                           S0501440
      IWRD = 0                                                          S0501450
      NIB = 2000                                                        S0501460
      GO TO 410                                                         S0501470
  230 NOGO = 2                                                          S0501480
      IF (IT2REC .LE. 0) GO TO 410                                      S0501490
      GO TO 400                                                         S0501500
  240 JSW = 1                                                           S0501510
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            N = 0
      250 N = N+1                                                          S0501520
          IF (N .GT. ADR2) GO TO 410                                       S0501530
      260 NOB = NOB+1                                                      S0501540
          IF (NOB .GT. NWRD) GO TO 270                                     S0501550
          BUFOT(NOB,2) = ADR1(N)                                           S0501560
          GO TO 250                                                        S0501570
      270 IT2REC = IT2REC+1                                                S0501580
      280 IF (NOB .GT. NWRD) NOB = NWRD                                    S0501590
          IF (NOB .LT. 4) NOB = 4                                          S0501600
    C     WRITE TAPE NOTFL(NO), 22=CLEAR I/O, 1=WRITE, NOB=NO. OF WORDS,   S0501610
    C     BUFOT(1,2)=BUFFER, IEOF=I/O STATUS -1=TRANSMISSION NOT COMPLETE  S0501620
    C     -2=EOT, -3 OR -4=ERROR                                           S0501630
          CALL NTRAN$(NOTFL(NO),22,1,NOB,BUFOT(1,2),IEOF)                  S0501640
      290 IF (IEOF .GT. 0) GO TO 370                                       S0501650
          IF (IEOF .EQ. -1) GO TO 290                                      S0501660
          IF (IEOF .EQ. -2) GO TO 310                                      S0501670
    C     WRITE ERROR                                                      S0501680
      300 WRITE (JUNT,9005) NOTFL(NO),IT2REC                               S0501690
          LINE = 200                                                       S0501700
          GO TO 230                                                        S0501710
    C     END OF TAPE MARK ENCOUNTERED                                     S0501720
      310 IF (NO+1 .LE. NOTTP) GO TO 320                                   S0501730
          WRITE (JUNT,9006)                                                S0501740
          LINE = LINE+2                                                    S0501750
          NOGO = 2                                                         S0501760
          GO TO 410                                                        S0501770
      320 IF (IT2REC .GT. 2) GO TO 350                                     S0501780
          WRITE (JUNT,9009) NOTFL(NO)                                      S0501790
          LINE = LINE+2                                                    S0501800
          NO = NO+1                                                        S0501810
          IF (NO .GT. NOTTP) GO TO 310                                     S0501820
          IF (IT2REC .LE. 1) GO TO 340                                     S0501830
    C     WRITE TAPE                                                       S0501840
          CALL NTRAN$(NOTFL(NO),22,1,NWRD,BUFOT(1,1),IEOF)                 S0501850
      330 IF (IEOF .GT. 0) GO TO 340                                       S0501860
          IF (IEOF .EQ. -1) GO TO 330                                      S0501870
          IT2REC = 1                                                       S0501880
                                                                           S0501890
            GO TO 300
        340 IT2REC = 0                                                           S0501900
            GO TO 270                                                            S0501910
      C     BACK SPACE TAPE NOTFL(NO) 2 BLOCKS                                   S0501920
        350 CALL NTRAN$(NOTFL(NO),22,7,-2,22,22)                                 S0501930
      C     WRITE 1 EOF MARK ON TAPE NOTFL(NO)                                   S0501940
            CALL NTRAN$(NOTFL(NO),22,9,22,22,22)                                 S0501950
      C     WRITE END OF TAPE SENTINEL, 14 WORDS FROM XEND                       S0501960
            CALL NTRAN$(NOTFL(NO),22,1,14,XEND,IEOF)                             S0501970
      C     WRITE 2 EOF MARKS ON TAPE NOTFL(NO) AND REWIND (10)                  S0501980
            CALL NTRAN$(NOTFL(NO),22,9,9,10,22)                                  S0501990
            IT2REC = IT2REC-2                                                    S0502000
            WRITE (JUNT,9007) NOTFL(NO),ISREC,IT2REC                             S0502010
            LINE = LINE+2                                                        S0502020
            NO = NO+1                                                            S0502030
            IF (NO .GT. NOTTP) GO TO 310                                         S0502040
            XFT = FLOAT(NWRD)*0.005625+0.75                                      S0502050
            IT2REC = IT2REC+1                                                    S0502060
            ISREC = IT2REC                                                       S0502070
      C     WRITE TAPE NOTFL(NO)                                                 S0502080
            CALL NTRAN$(NOTFL(NO),22,1,NWRD,BUFOT(1,1),IEOF)                     S0502090
        360 IF (IEOF .GT. 0) GO TO 270                                           S0502100
            IF (IEOF .EQ. -1) GO TO 360                                          S0502110
            GO TO 300                                                            S0502120
        370 XFT = XFT+FLOAT(NWRD)*0.005625+0.75                                  S0502130
            NOB = 0                                                              S0502140
            IF (JSW .NE. 1) GO TO 400                                            S0502150
            DO 380 J=1,NWRD                                                      S0502160
        380 BUFOT(J,1) = BUFOT(J,2)                                              S0502170
            GO TO 260                                                            S0502180
        390 JSW = 2                                                              S0502190
            IF (NOB .GT. 0) GO TO 270                                            S0502200
      C     CLOSE OUTPUT FILE, WRITE 2 EOF MARKS AND BACK TAPE BETWEEN THEM      S0502210
        400 CALL NTRAN$(NOTFL(NO),22,9,9,8,-1)                                   S0502220
            XFT = (XFT+12.0)/12.0                                                S0502230
            WRITE (JUNT,9008) NOTFL(NO),ISREC,IT2REC,XFT                         S0502240
            LINE = LINE+1                                                        S0502250
        410 CONTINUE                                                             S0502260
                                                                                 S0502270
      RETURN                                                            S0502280
 9001 FORMAT (24H1*** READ ERROR ON UNIT ,I2,11H AT RECORD ,I6/)        S0502290
 9002 FORMAT (25H1*** END OF DATA ON UNIT ,I2,2H, ,I6,13H RECORDS READ/)S0502300
 9003 FORMAT (25H0*** END OF FILE ON UNIT ,I2,2H, ,I6,13H RECORDS READ/)S0502310
 9004 FORMAT (86H0*** WARNING - MORE INPUT REELS THAN UNITS ASSIGNED PROS0502320
     1G. GOING TO FIRST UNIT ASSIGNED/)                                 S0502330
 9005 FORMAT (25H1*** WRITE ERROR ON UNIT ,I2,11H AT RECORD ,I6/)       S0502340
 9006 FORMAT (71H0*** ERROR - MORE OUTPUT REELS REQUIRED THAN UNITS ASSIS0502350
     1GNED, PROG STOPS)                                                 S0502360
 9007 FORMAT (32H0*** END OF OUTPUT REEL ON UNIT ,I2,9H RECORDS ,I6,9H TS0502370
     1HROUGH ,I6,8H WRITTEN/)                                           S0502380
 9008 FORMAT (32H *** END OF OUTPUT DATA ON UNIT ,I2,9H RECORDS ,I6,9H TS0502390
     1HROUGH ,I6,10H WRITTEN, ,F8.3,19H FEET OF TAPE USED/)             S0502400
 9009 FORMAT (47H0*** WARNING - NOT ENOUGH ROOM ON REEL ON UNIT ,I2,44H S0502410
     1PROG. STARTS FIRST OUTPUT REC. ON NEXT REEL/)                     S0502420
      END                                                               S0502430
      SUBROUTINE TITLR(IFLG1,IFLG2,IFLG3)                               S0600000
C                                                                       S0600010
      INTEGER TITLE                                                     S0600020
C                                                                       S0600030
      DIMENSION ICONT1(2),ICONT2(2),ICONT(2)                            S0600040
C                                                                       S0600050
      COMMON /DIM/ NSOURC,NXPNTS,NYPNTS,NSEASN,NSPEED,NSTBLE,NSCTOR,    S0600060
     1NXWYPT,TITLE(20),LUNT(6),LKNT(3),NSORY,ISW(20),IOVRSN,NGROUP,NSTOPS0600070
     2,NSORX                                                            S0600080
      COMMON /RST/ MLT(3),NLT(3),PHC(16),PHS(16),QS1(4),                S0600090
     1XZ(6,6,4),UBHP(6,6,4),NSOGRP(1000),IDSOR(1000),HP(6,6,4),NLINES   S0600100
     2,MUNT(4),ITABLE,IPAGE,LINE,IPC,IDATE(2),IUNT,JUNT,IBLNK           S0600110
C                                                                       S0600120
      DATA ICONT1/4HCON,2HT)/,ICONT2/2*1H /                             S0600130
C                                                                       S0600140
      IPC = 0                                                           S0600150
      IF (IFLG1 .EQ. 0) GO TO 10                                        S0600160
      LINE = LINE+IFLG2                                                 S0600170
      IF (LINE .LE. NLINES) GO TO 80                                    S0600180
   10 IPAGE = IPAGE+1                                                   S0600190
      IF (IFLG1 .EQ. 0) GO TO 20                                        S0600200
      ICONT(1) = ICONT1(1)                                              S0600210
      ICONT(2) = ICONT1(2)                                              S0600220
      GO TO 30                                                          S0600230
   20 ICONT(1) = ICONT2(1)                                              S0600240
      ICONT(2) = ICONT2(2)                                              S0600250
      ITABLE = ITABLE+1                                                 S0600260
   30 IPC = 1                                                           S0600270
      WRITE (JUNT,9001) TITLE,IDATE,IPAGE,ITABLE,ICONT                  S0600280
      LINE = 4+IFLG2                                                    S0600290
      GO TO (40,50,60,80),IFLG3                                         S0600300
   40 WRITE (JUNT,9002)                                                 S0600310
      GO TO 70                                                          S0600320
   50 WRITE (JUNT,9003)                                                 S0600330
      GO TO 70                                                          S0600340
   60 WRITE (JUNT,9004)                                                 S0600350
   70 LINE = LINE+2                                                     S0600360
   80 CONTINUE                                                          S0600370
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      RETURN                                                            S0600380
 9001 FORMAT (1H1,15X,20A4,14X,5HDATE ,A4,A2,6H, PAGE,I5//60X,5HTABLE,I5S0600390
     1,1X,A4,A2/)                                                       S0600400
 9002 FORMAT (35X,59H*-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMES0600410
     1TERS *-*/)                                                        S0600420
 9003 FORMAT (53X,25H*-* INPUT SOURCE DATA *-*/)                        S0600430
 9004 FORMAT (50X,31H*-* OUTPUT SOURCE INVENTORY *-*/)                  S0600440
      END                                                               S0600450
      SUBROUTINE ASSIGN(NREC,LREC,IER,JUNT)                              S0700000
C                                                                        S0700010
C     SUBROUTINE TO EXECUTE UNIVAC JCL TO ASSIGN MASS STORAGE FILE       S0700020
C                                                                        S0700030
      DIMENSION IASG(9),JASG(6),KASG(4),LASG(6)                          S0700040
C                                                                        S0700050
      EQUIVALENCE (JER,RER,X)                                            S0700060
C                                                                        S0700070
C     UNIVAC JCL @ASG - ASSIGN MASS STORAGE FILE (PROGRAM NAMES FILE)    S0700080
      DATA IASG/4H@ASG,2H,T,3*1H ,4H..F/,4H/POS,1H/,1H./                 S0700090
C     UNIVAC JCL @USE - EQUATE LU 12 WITH ASSIGNED FILE                  S0700100
      DATA JASG/4H@USE,4H 12,,3*1H ,3H. ./                               S0700110
C     UNIVAC JCL @FREE - RELEASE PREVIOUS EQUATE LU 12                   S0700120
      DATA KASG/4H@FRE,3HE,C,4H12 .,1H /                                 S0700130
C     UNIVAC JCL @FREE - RELEASE PREVIOUS ASSIGNED FILE                  S0700140
      DATA LASG/4H@FRE,3HE,C,3*1H ,3H. ./,LST/-1/                        S0700150
C                                                                        S0700160
      NREC = NREC+1                                                      S0700170
      X = FLOAT(NREC*LREC)*9.71931E-6+1.5                                S0700180
      L = X                                                              S0700190
      DO 10 I=1,2                                                        S0700200
C$$$$                                                                    S0700210
C     THIS CODING ASSUMES 36 BITS PER WORD, 4 CHARACTERS PER WORD,       S0700220
C     9 BITS PER CHARACTER.                                              S0700230
      I1 = (31-I)*9                                                      S0700240
      I2 = MOD(I1,36)+1                                                  S0700250
      I1 = I1/36+1                                                       S0700260
      M = L/10                                                           S0700270
C     48 IS THE DECIMAL (INTEGER) EQUIVALENT OF THE CHARACTER 0 (ZERO).  S0700280
      K = L-M*10+48                                                      S0700290
C     TAKE 9 BITS FROM K STARTING AT BIT 28 AND STORE INTO IASG(I1)      S0700300
C     STARTING AT BIT I2. THE REMAINDER OF IASG(I1) IS UNCHANGED.        S0700310
C     BITS ARE COUNTED FROM THE LEFT (SIGN BIT) STARTING WITH 1.         S0700320
      BITS(IASG(I1),I2,9) = BITS(K,28,9)                                 S0700330
C$$$$                                                                    S0700340
      L = M                                                              S0700350
   10 CONTINUE                                                           S0700360
   20 LST = LST+1                                                        S0700370
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      M = (NREC+LST)*10000+LREC+LST                                     S0700380
      DO 30 I=1,12                                                      S0700390
      L = M/10                                                          S0700400
C     65 IS THE DECIMAL (INTEGER) EQUIVALENT OF THE CHARACTER A.        S0700410
      K = M-L*10+65                                                     S0700420
      M = L                                                             S0700430
C$$$$                                                                   S0700440
C     THIS CODING ASSUMES 36 BITS PER WORD, 4 CHARACTERS PER WORD,      S0700450
C     9 BITS PER CHARACTER.                                             S0700460
      I1 = (7+I)*9                                                      S0700470
      I2 = MOD(I1,36)+1                                                 S0700480
      I1 = I1/36+1                                                      S0700490
C     TAKE 9 BITS FROM K STARTING AT BIT 28 AND STORE INTO IASG(I1)     S0700500
C     STARTING AT BIT I2.                                               S0700510
      BITS(IASG(I1),I2,9) = BITS(K,28,9)                                S0700520
C$$$$                                                                   S0700530
   30 CONTINUE                                                          S0700540
      DO 40 I=3,5                                                       S0700550
      JASG(I) = IASG(I)                                                 S0700560
   40 LASG(I) = IASG(I)                                                 S0700570
C     EXECUTE UNIVAC EXECUTIVE REQUEST FUNCTION TO EXECUTE A UNIVAC JCL S0700580
C     COMMAND. @FREE                                                    S0700590
      RER = FACSF(KASG)                                                 S0700600
C     @ASG                                                              S0700610
      RER = FACSF(IASG)                                                 S0700620
      IF (JER .GE. 0) GO TO 70                                          S0700630
C     TAKE 1 BIT FROM JER STARTING AT BIT 3 AND STORE RIGHT JUSTIFIED   S0700640
C     INTO I, ZERO THE REST OF I.                                       S0700650
      I = BITS(JER,3,1)                                                 S0700660
      IF (I .EQ. 0) GO TO 50                                            S0700670
C     @FREE                                                             S0700680
      RER = FACSF(LASG)                                                 S0700690
      GO TO 20                                                          S0700700
   50 WRITE (JUNT,9001) IASG,JER                                        S0700710
   60 IER = -1                                                          S0700720
      GO TO 90                                                          S0700730
C     @USE                                                              S0700740
   70 RER = FACSF(JASG)                                                 S0700750
```

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            IF (JER .GE. 0) GO TO 90                                    S0700760
            WRITE (JUNT,9001) JASG,JER                                  S0700770
            GO TO 60                                                    S0700780
         80 IER = JER                                                   S0700790
         90 RETURN                                                      S0700800
       9001 FORMAT (1H0,9A4/24H FAC REJECTED, STATUS = ,O12)            S0700810
            END                                                         S0700820
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. THIS IS A UNIVAC ASSEMBLER PROCEDURE USED BY SUBROUTINE DEFFIL.
. USE THE UNIVAC PDP PROCESSOR TO ENTER THIS PROCEDURE INTO THE
. PROGRAM FILE (@PDP,IS FILENAME.IBJ,FILENAME.IBJ)
.
IBJ*      PROC      1,2
F         FORM      10,4,4,18
 DO 1-(IBJ(1)=2) ,X EQU 09
          LXI,U     IBJ(1,1),BDICALL$+IBJ(1,2)
          F         IBJ$,IBJ(1,1),0,IBJ(1,2)
          END
```

```
      .  SUBROUTINE DEFFIL
      .  THIS ROUTINE ALLOWS ASCII FORTRAN PROGRAMS TO DO 'DYNAMIC'
      .  DEFINE FILE'S.
      .  (USE THE UNIVAC MASM COMPILER TO ASSEMBLE THIS ROUTINE)
      .  (ALSO THE IBJ INSTRUCTION BELOW IS AN ASSEMBLER PROCEDURE
      .  (DEFINED ABOVE
      .
      .  CALL IS:
      .
      .            CALL DEFFIL (UNIT, MAX, LEN, TYPE, AV)
      .
      .    UNIT - INT - THE ASCII FORTRAN UNIT NUMBER.
      .
      .     MAX - INT - THE MAXIMUM NUMBER OF RECORDS IN THE FILE
      .
      .     LEN - INT - THE LENGTH OF EACH RECORD IN THE FILE.
      .
      .    TYPE - INT - THE FILE TYPE:
      .
      .                  1 - L
      .                  2 - M
      .                  3 - E
      .                  4 - F
      .                  5 - U
      .                  6 - V
      .
      .      AV -     - THE ASSOC. VARIABLE FOR THE FILE.
      .
      .
      .    JIM SCHLIGHT, UNIVERSITY OF UTAH COMPUTER CENTER, 3116 MEB,
      .                  SALT LAKE CITY, UTAH  84112    (801) 581-6802
      .
      .
              AXR$
              ASCII
     $(0)
```

```
PACKET     +       0777777,0   . 0)         777777 \ UNIT #
           +       0010000,0   . 1) 010000 + FILETYPE \ RECORD LENGTH (WORDS)
           +               0   . 2)      ADDRESS OF THE ASSOC. VARIABLE
           +               0   . 3)         MAX NUMBER OF RECORDS
                               .                      \
RETURN     RES     1                  .

$(1)
DEFFIL*.   SX      X11,RETURN         . SAVE OUR RETURN

           L       A1,*0,A0           . UNIT NUMBER
           S,H2    A1,PACKET          .

           L       A1,*1,A0           . MAX NUMBER OF RECORDS
           S       A1,PACKET+3        .

           L       A1,*2,A0           . RECORD-LENGTH
           SA,H2   A1,PACKET+1        .

           L       A1,*3,A0           . FILE-TYPE
           SA,S3   A1,PACKET+1        .

           L       A1,4,A0            . ADDR OF ASSOC. VARIABLE
           SA      A1,PACKET+2        .

           LXM,U   A0,PACKET          . DO THE DEFINE FILE
           IBJ     X11,F2DI$$         .

           L       X11,RETURN         .
           J       0,X11              . GO BACK
           END
```

APPENDIX C

EXAMPLE EXECUTION OF THE SHORT-TERM MODEL (SHORTZ) COMPUTER PROGRAM

C.1 INTRODUCTION

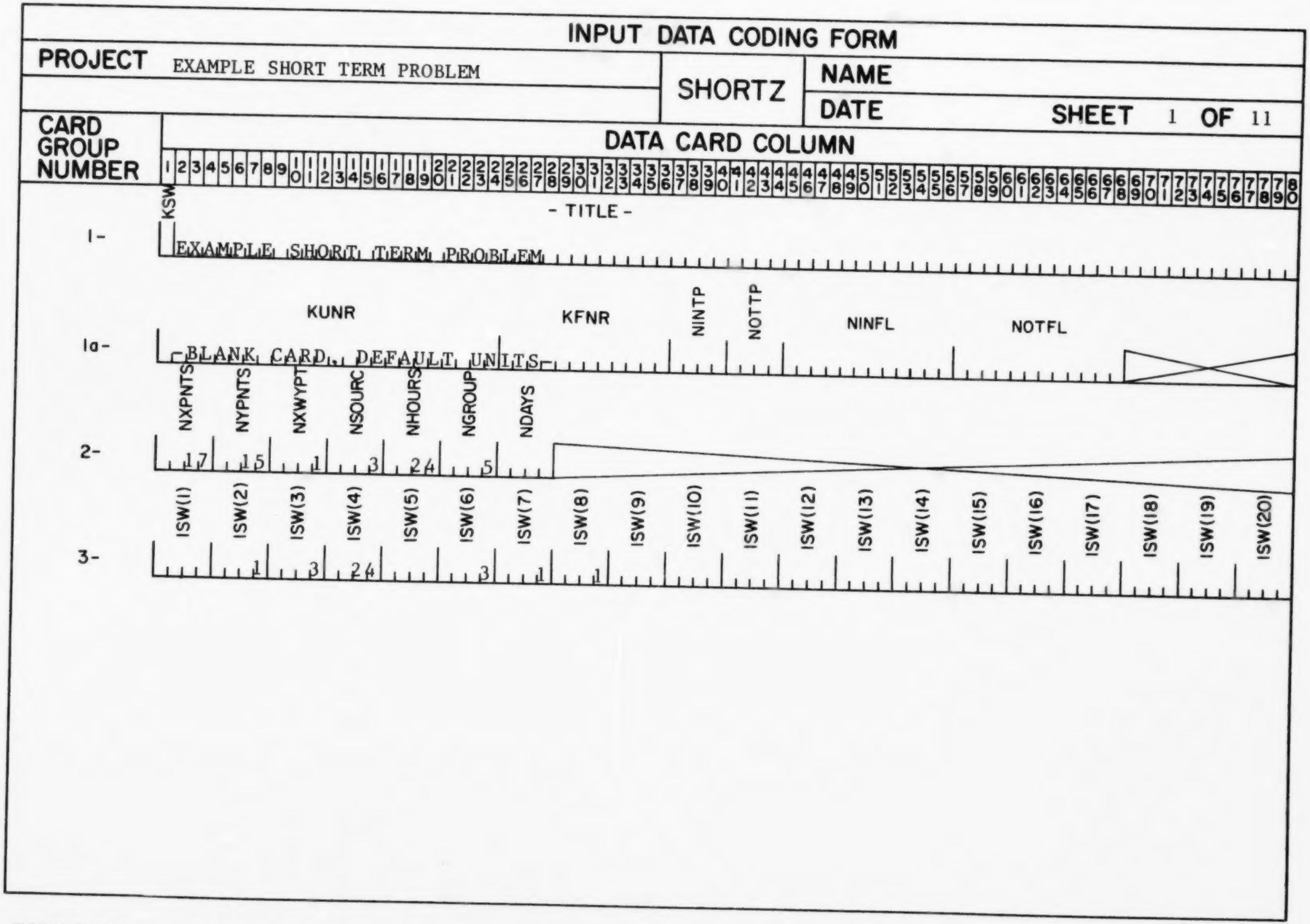
The following example problem run uses the short-term (SHORTZ) program to model the Logans Ferry air pollution episode described in Section 2.6.1. This example run calculates hourly, 3-hour and 24-hour average ground-level concentrations using Pittsburgh, Pennsylvania meteorological data for 4 January 1973. This appendix assumes the user is familiar with the example as discussed in Section 2.6.1 of the main body of the text. Also, this appendix assumes the user is familiar with the User's Instructions for the short-term program outlined in Section 3.

C.2 EXAMPLE CONCENTRATION RUN

This program example run calculates the hourly, 3-hour and 24-hour average ground-level concentrations produced by emissions from the three stacks described in Section 2.6.1 and shown in Figure 2-5. The Cheswick and West Penn Power Plants are modeled as 1 and 2 stacks, respectively. The meteorological inputs as well as required control data, run time estimate, and page output estimate are explained in Sections C.2.1 through C.2.3 below.

C.2.1 Input Data Set-Up Procedure

This example run requires the input data shown in the example coding forms in Figure C-1. An explanation of each card group in Figure C-1 is given in Sections C.2.1.a through C.2.1.q below.



INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE

SHEET 1 OF 11

CARD GROUP NUMBER

DATA CARD COLUMN

1- KSW

- TITLE -

EXAMPLE SHORT TERM PROBLEM

1a-

KUNR	KFNR	NINTP	NOTTP	NINFL	NOTFL
BLANK CARD, DEFAULT UNITS					

2-

NXPNTS	NYPNTS	NXWYPT	NSOURC	NHOURS	NGROUP	NDAYS
17	15	1	3	24	5	

3-

ISW(1)	ISW(2)	ISW(3)	ISW(4)	ISW(5)	ISW(6)	ISW(7)	ISW(8)	ISW(9)	ISW(10)	ISW(11)	ISW(12)	ISW(13)	ISW(14)	ISW(15)	ISW(16)	ISW(17)	ISW(18)	ISW(19)	ISW(20)
	1	3	24		3	1	1												

FIGURE C-1. Coding form for the SHORTZ example problem.

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE

SHEET 2 OF 11

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- X (axis of grid system, omit if NXPNTS = 0 or KSW = 1 or 3) -

4-	602000	603000	604000	604500	605000	605500	606000	606500
	607000	607500	608000	608500	609000	609500	510000	611000
	612000							

- X (arbitrarily placed receptors, omit if NXWYPT = 0 or KSW = 1 or 3) -

4a-	605167							

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE

SHEET 3 **OF** 11

CARD GROUP NUMBER	DATA CARD COLUMN 1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
	- X (arbitrarily placed receptors, continued) -							
4a (Cont.)								
	- Y (axis of grid system, omit if NYPNTS = 0 or KSW = 1 or 3) -							
5-	4487000	4488000	4488500	4489000	4489500	4490000	4490500	4491000
	4491500	4492000	4493000	4494000	4495000	4496000	4497000	

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE

SHEET 4 OF 11

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Y (arbitrarily placed receptors, omit if NXWYPT = 0 or KSW = 1 or 3) -

	4489107							
5a-								

- ZZ (grid system elevations, omit if ISW(7) = 0 or KSW = 1 or 3 or NXPNTS = 0) -

	358	347	317	341	375	396	332	351
	387	305	280	381	300	256	286	305
	375							
	230	230	226	229	274	349	360	305
5b-	366	317	296	247	280	366	354	373
	320							
	250	259	230	226	262	282	320	370
	279	250	241	305	286	326	372	335
	381							

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE

SHEET 5 **OF** 11

CARD GROUP NUMBER

DATA CARD COLUMN

- ZZ (grid system elevations, continued) -

CARD GROUP NUMBER	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
5b- (Cont.)	241	308	253	226	238	268	314	262
	274	250	280	363	329	293	347	314
	366							
	288	296	290	226	232	229	238	244
	250	241	329	293	347	354	360	372
	366							
	338	308	232	220	220	290	323	280
	280	274	265	311	355	354	347	335
	360							
	354	280	226	232	220	282	296	335
	320	200	323	315	354	311	314	290
	206							
	335	320	226	235	258	244	293	326
	338	323	320	370	372	372	277	344
	320							
	326	317	229	238	268	235	286	305
	338	360	363	360	354	290	320	360
	335							
	311	344	226	244	286	206	229	290

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE SHEET 6 OF 11

CARD GROUP NUMBER	DATA CARD COLUMN							
	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
	- ZZ (grid system elevations, continued) -							
5b- (Cont.)	280	399	349	305	283	283	293	360
	363							
	305	244	229	250	305	274	268	296
	300	274	290	271	290	286	317	320
	396							
	286	349	232	226	285	293	299	329
	323	314	323	274	290	288	296	308
	326							
	317	363	364	265	238	232	226	226
	232	286	236	293	296	311	274	290
	323							
	349	317	323	308	229	241	280	267
	256	232	232	229	268	323	308	338
	344							
	329	347	320	235	258	311	286	280
	280	302	280	229	226	254	314	335
	344							

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

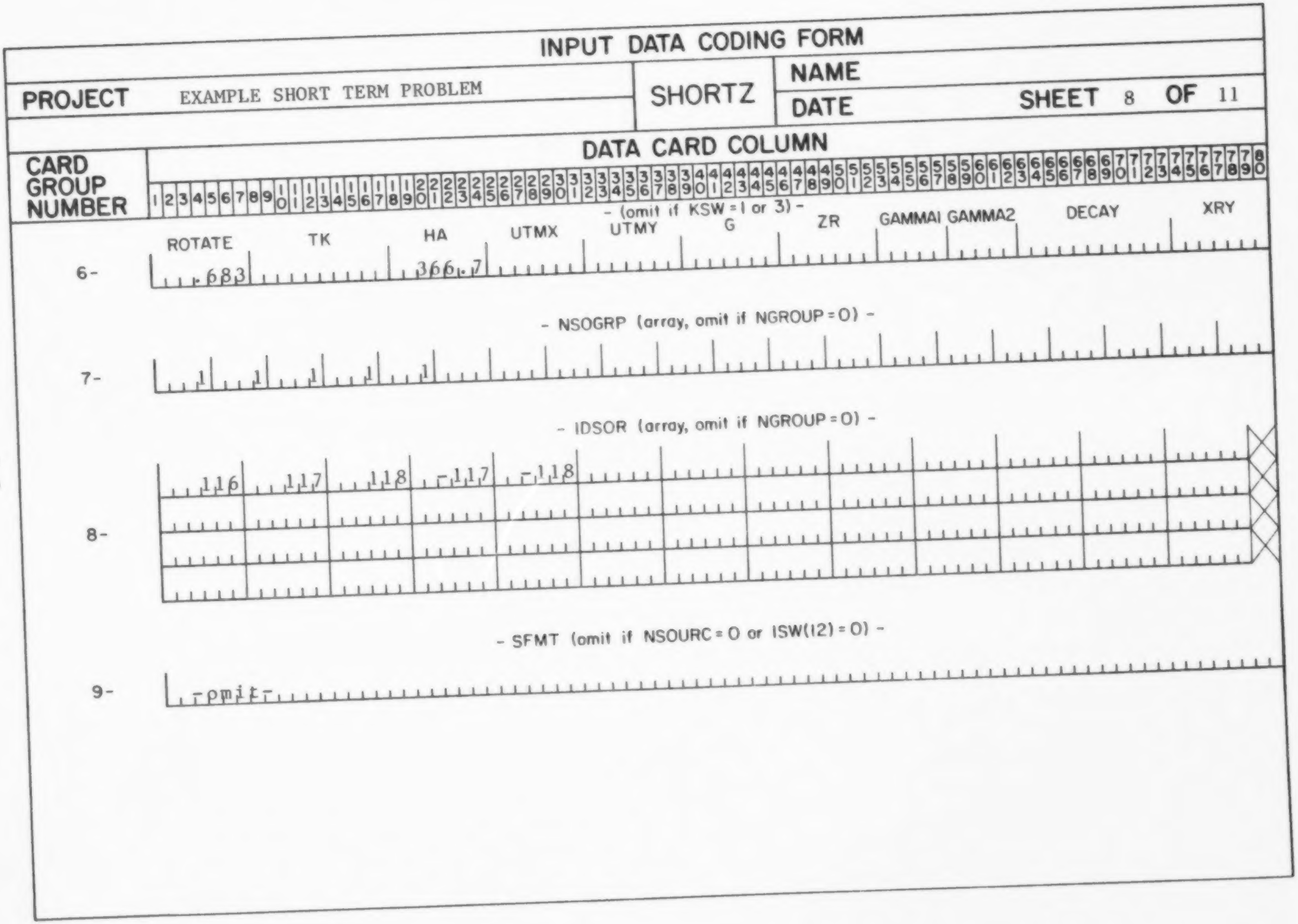
SHORTZ

NAME

DATE **SHEET** 7 **OF** 11

CARD GROUP NUMBER	DATA CARD COLUMN
	- ZZ (arbitrarily placed receptors, omit if ISW(7) = 0, NXWYPT = 0, KSW = 1 or 3) -
5c-	274

FIGURE C-1. (Continued)



INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE **SHEET** 8 **OF** 11

DATA CARD COLUMN

CARD GROUP NUMBER

6- ROTATE: .683 TK: HA: 366.7 UTMX: UTMY: G: ZR: GAMMA1: GAMMA2: DECAY: XRY:

- (omit if KSW = 1 or 3) -

- NSOGRP (array, omit if NGROUP = 0) -

7- 1 1 1 1 1

- IDSOR (array, omit if NGROUP = 0) -

8- 116 117 118 -117 -118

- SFMT (omit if NSOURC = 0 or ISW(12) = 0) -

9- -omit-

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE SHEET 9 OF 11

CARD GROUP NUMBER

DATA CARD COLUMN

- (omit if NSOURC = 0) -

CARD GROUP NUMBER	NUMSQ	TYPE	DISP	JFLG	Q	DX	DY	H	HS	TS or SI	VOL or S2	DTH	RDS	NS
**9a-	116				318.15	604380	4488740	67.1	220	472	160.98		2.60	
	117				318.15	604380	4488740	62.5	220	444	162.14		1.85	
	118				1260.00	602330	4487800	220.0	220	411	881.46		3.20	

** This form shows the default format for Card Group 9a.

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE SHEET 10 OF 11

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- (omit if KSW=1 or 3) -

CARD GROUP NUMBER	HOUR	THETA	UBAR	HM	TA	DPDZ	ISTBLE	P	SIGEPU	SIGAPU	SIGEPL	SIGAPL	ALPHA
11-	0100	170	5.4017	953	283			.17	.0735	.1051	.0735	.1051	
	0200	190	6.6878	1068	284			.17	.0735	.1051	.0735	.1051	
	0300	210	10.0316	1184	285			.17	.0735	.1051	.0735	.1051	
	0400	220	9.7744	1299	285			.17	.0735	.1051	.0735	.1051	
	0500	245	8.2311	1415	283			.17	.0735	.1051	.0735	.1051	
	0600	255	9.2600	1530	282			.17	.0735	.1051	.0735	.1051	
	0700	255	9.7744	1645	280			.17	.0735	.1051	.0735	.1051	
	0800	250	10.2889	1598	280			.17	.0735	.1051	.0735	.1051	
	0900	250	9.0028	1551	280			.17	.0735	.1051	.0735	.1051	
	1000	250	8.4883	1504	279			.17	.0735	.1051	.0735	.1051	
	1100	250	8.2311	1457	279			.17	.0735	.1051	.0735	.1051	
	1200	250	7.2022	1410	279			.17	.0735	.1051	.0735	.1051	
	1300	250	9.2600	1363	279			.17	.0735	.1051	.0735	.1051	
	1400	250	7.7167	1316	278			.17	.0735	.1051	.0735	.1051	
	1500	255	6.6878	1269	278			.17	.0735	.1051	.0735	.1051	
	1600	260	6.1733	1221	277			.17	.0735	.1051	.0735	.1051	
	1700	260	7.7167	1174	276			.17	.0735	.1051	.0735	.1051	
	1800	265	6.6878	1127	276			.17	.0735	.1051	.0735	.1051	
	1900	260	7.7167	1080	275			.17	.0735	.1051	.0735	.1051	

FIGURE C-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE SHORT TERM PROBLEM

SHORTZ

NAME

DATE **SHEET** 11 **OF** 11

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- (omit if KSW=1 or 3) -

CARD GROUP NUMBER	HOUR	THETA	UBAR	HM	TA	DPDZ	ISTBLE	P	SIGEPU	SIGAPU	SIGEPL	SIGAPL	ALPHA
11-	2000	250	6.6878	1033	275			.17	.0735	.1051	.0735	.1051	
	2100	250	5.9161	986	275			.17	.0735	.1051	.0735	.1051	
	2200	240	6.1733	939	275			.17	.0735	.1051	.0735	.1051	
	2300	260	6.1733	892	274			.17	.0735	.1051	.0735	.1051	
	0000	270	5.9161	845	274			.17	.0735	.1051	.0735	.1051	

FIGURE C-1. (Continued)

a. Card Group 1 - Card Group 1 gives the tape use flag KSW and the user selected title for the program run. The flag KSW is not punched (blank) because we are not using an input or output tape for this example run. Also, the program interprets blanks as zero, when read in a numeric field. The title shown in Card Group 1 of Figure C-1 is printed at the top of each output page as shown in Figure C-2.

b. Card Group 1a - Card Group 1a gives the output concentration units, the input source emission units and the parameters used to define the input/output logical tape unit numbers. This card has been left blank because we wish to use the program default values and there is no tape I/O. This card must still be included in the input deck even though it is blank.

c. Card Group 2 - This card group shows we are using a "17" by "15" point grid system with one discrete point. The discrete point corresponds to the location of the SO_2 monitor mentioned in Seciton 2.6.1. Also, this card shows we are using "3" sources, the meteorological data covers a "24" hour period and we require concentration tables from "5" different combinations of the sources. As we have only one meteorological data case, the parameter NDAYS is left blank (defaults to "1").

d. Card Group 3 - This card group provides the program options desired. The parameter ISW(1) defaults to "1", indicating hourly input meteorological data. ISW(2) directs the program to print hourly concentrations for each hour, for each source combination desired. ISW(3) specifies that 3-hour average concentrations are to be printed for each consecutive 3-hour period, for each source combination desired. ISW(4) specifies that 24-hour average concentrations are to be printed for each source combination desired. ISW(5) is not used in this run. ISW(6) specifies all input control and source data are to be printed. ISW(7) specifies terrain elevation data are included in the input deck. ISW(8) directs the program to print the input meteorological data. The program uses the default values provided for the options ISW(9) through ISW(20).

```
                    EXAMPLE SHORT TERM PROBLEM                                                DATE 040679, CASE  1, PAGE    1
                                                  TABLE    1
                                            - GENERAL INPUT DATA -
     NUMBER OF INPUT SOURCES                                        (NSOURC) =     3
     NUMBER OF X GRID COORDINATES                                   (NXPNTS) =    17
     NUMBER OF Y GRID COORDINATES                                   (NYPNTS) =    15
     TOTAL NUMBER OF HOURS IN EACH DAY                              (NHOURS) =    24
     NUMBER OF DAYS OR CASES                                        ( NDAYS) =     1
     NUMBER OF CONCENTRATION REPORTS (SOURCE COMBINATIONS)          (NGROUP) =     5
     NUMBER OF DISCRETE CALCULATION POINTS                          (NXWYPT) =     1
     MET DATA INPUT CARD RATE (1=HOURLY,2=2 HOURLY,ETC)             (ISW(1)) =     1
     IS CONCENTRATION CALCULATED AT BASE RATE PRINTED               (ISW(2)) =     1
     NO  OF HOURS IN FIRST AVERAGE CONCENTRATION PRINTED            (ISW(3)) =     3
     NO  OF HOURS IN SECOND AVERAGE CONCENTRATION PRINTED           (ISW(4)) =    24
     NO  OF HOURS IN THIRD AVERAGE CONCENTRATION PRINTED            (ISW(5)) =     0
     ARE TERRAIN ELEVATION HEIGHTS USED                             (ISW(7)) =     1
     IS WIND SPEED TERRAIN FOLLOWING                                (ISW(9)) =     0
     ARE CONCENTRATIONS AVERAGED OVER DAYS OR CASES                 (ISW(11))=     0
     IS THE FORMAT FOR SOURCE DATA READ                             (ISW(12))=     0
     IS COORDINATE SYSTEM CARTESIAN (=0) OR POLAR (=1)              (ISW(13))=     0
     ARE DISCRETE RECEPTORS CARTESIAN (=0) OR POLAR (=1)            (ISW(14))=     0
     ARE SOURCE COORDINATES CARTESIAN (=0) OR POLAR (=1)            (ISW(15))=     0
     MODEL UNITS CONVERSION FACTOR                                  (   TK   ) =   .1000000+07
     ACCELERATION OF GRAVITY                                        (   G    ) =    9.8000       (METERS/SEC**2)
     HEIGHT OF MEASUREMENT OF WIND SPEED, ETC                       (   ZR   ) =    6.0960       (METERS)
     ENTRAINMENT COEFFICIENT FOR UNSTABLE ATMOSPHERE                (GAMMA1) =    .600
     ENTRAINMENT COEFFICIENT FOR STABLE ATMOSPHERE                  (GAMMA2) =    .660
     DISTANCE OVER WHICH RECTILINEAR PLUME EXPANSION OCCURS ( XRY    ) = 50.0000            (METERS)
     DECAY COEFFICIENT FOR PHYSICAL OR CHEMICAL DEPLETION  (DECAY ) =,   .00000000
     ANGULAR DISPL OF GRID SYSTEM FROM TRUE NORTH                   (ROTATE) =      .683
     ELEVATION OF BASE OF WEATHER STATION                              (HA) =  366.70        (METERS)
     X ORIGIN OF POLAR COORDINATES                                  (UTMX) =        .00      (METERS)
     Y ORIGIN OF POLAR COORDINATES                                  (UTMY) =        .00      (METERS)
                *-* COORDINATE SYSTEM X AXIS (METERS) *-*

 .6020000+06,   .6030000+06,   .6040000+06,   .6045000+06,   .6050000+06,   .6055000+06,   .6060000+06,   .6065000+06,
 .6070000+06,   .6075000+06,   .6080000+06,   .6085000+06,   .6090000+06,   .6095000+06,   .6100000+06,   .6110000+06,
 .6120000+06,
                *-* COORDINATE SYSTEM Y AXIS (METERS) *-*

 .4487000+07,   .4488000+07,   .4488500+07,   .4489000+07,   .4489500+07,   .4490000+07,   .4490500+07,   .4491000+07,
 .4491500+07,   .4492000+07,   .4493000+07,   .4494000+07,   .4495000+07,   .4496000+07,   .4497000+07,
                                      *-* COORDINATES OF DISCRETE POINTS (METERS,METERS) *-*

(X,Y) = ( 605167.0, 4489107.0), (
     NUMBER OF SOURCES IN EACH CONCENTRATION REPORT GROUP 1 TO   5 =   1,   1,   1,   1,   1,
     SOURCE NUMBERS FOR EACH OF THE ABOVE GROUPS =    116,    117,    118,   -117,   -118,
```

FIGURE C-2.   Example output listing from the short-term example problem.

```
                    EXAMPLE SHORT TERM PROBLEM                                              DATE 040679, CASE  1, PAGE    2

                                                     TABLE    2

                                                 - GENERAL INPUT DATA -

                                      *-* GRID SYSTEM TERRAIN HEIGHTS (METERS) *-*

                                                 - GRID SYSTEM X AXIS (METERS) -
                 602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                                  - HEIGHT -
                 ----------------------------------------------------------------------------------------------------------------

  4497000.000    329.0000000  347.0000000  320.0000000  235.0000000  258.0000000  311.0000000  296.0000000  280.0000000  280.0000000
  4496000.000    349.0000000  317.0000000  323.0000000  308.0000000  229.0000000  241.0000000  280.0000000  267.0000000  256.0000000
  4495000.000    317.0000000  363.0000000  364.0000000  265.0000000  238.0000000  232.0000000  226.0000000  226.0000000  232.0000000
  4494000.000    286.0000000  349.0000000  232.0000000  226.0000000  285.0000000  293.0000000  299.0000000  329.0000000  323.0000000
  4493000.000    305.0000000  244.0000000  229.0000000  250.0000000  305.0000000  274.0000000  268.0000000  296.0000000  300.0000000
  4492000.000    311.0000000  344.0000000  226.0000000  244.0000000  286.0000000  296.0000000  229.0000000  299.0000000  280.0000000
  4491500.000    326.0000000  317.0000000  229.0000000  238.0000000  268.0000000  235.0000000  286.0000000  305.0000000  338.0000000
  4491000.000    335.0000000  320.0000000  226.0000000  235.0000000  258.0000000  244.0000000  293.0000000  326.0000000  338.0000000
  4490500.000    354.0000000  290.0000000  226.0000000  232.0000000  229.0000000  282.0000000  296.0000000  335.0000000  320.0000000
  4490000.000    338.0000000  308.0000000  232.0000000  229.0000000  229.0000000  290.0000000  323.0000000  280.0000000  280.0000000
  4489500.000    288.0000000  296.0000000  290.0000000  226.0000000  232.0000000  229.0000000  238.0000000  244.0000000  250.0000000
  4489000.000    241.0000000  308.0000000  253.0000000  226.0000000  238.0000000  268.0000000  314.0000000  262.0000000  274.0000000
  4488500.000    250.0000000  259.0000000  230.0000000  226.0000000  262.0000000  282.0000000  320.0000000  370.0000000  274.0000000
  4488000.000    230.0000000  230.0000000  226.0000000  229.0000000  274.0000000  349.0000000  360.0000000  305.0000000  366.0000000
  4487000.000    358.0000000  347.0000000  317.0000000  341.0000000  375.0000000  396.0000000  332.0000000  351.0000000  387.0000000

                                                 - GRID SYSTEM X AXIS (METERS) -
                 607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                                  - HEIGHT -
                 ----------------------------------------------------------------------------------------------------------------

  4497000.000    302.0000000  290.0000000  229.0000000  226.0000000  254.0000000  314.0000000  335.0000000  344.0000000
  4496000.000    232.0000000  232.0000000  229.0000000  268.0000000  323.0000000  308.0000000  338.0000000  344.0000000
  4495000.000    286.0000000  235.0000000  293.0000000  296.0000000  311.0000000  274.0000000  290.0000000  323.0000000
  4494000.000    314.0000000  323.0000000  274.0000000  290.0000000  288.0000000  296.0000000  308.0000000  326.0000000
  4493000.000    274.0000000  290.0000000  271.0000000  290.0000000  286.0000000  317.0000000  320.0000000  396.0000000
  4492000.000    399.0000000  349.0000000  305.0000000  283.0000000  283.0000000  293.0000000  360.0000000  363.0000000
  4491500.000    369.0000000  363.0000000  360.0000000  354.0000000  290.0000000  320.0000000  369.0000000  335.0000000
  4491000.000    323.0000000  320.0000000  379.0000000  372.0000000  372.0000000  277.0000000  344.0000000  329.0000000
  4490500.000    290.0000000  323.0000000  315.0000000  354.0000000  311.0000000  314.0000000  290.0000000  296.0000000
  4490000.000    274.0000000  265.0000000  311.0000000  355.0000000  354.0000000  347.0000000  335.0000000  360.0000000
  4489500.000    241.0000000  329.0000000  293.0000000  347.0000000  354.0000000  360.0000000  372.0000000  366.0000000
  4489000.000    250.0000000  290.0000000  363.0000000  329.0000000  293.0000000  347.0000000  314.0000000  366.0000000
  4488500.000    250.0000000  241.0000000  305.0000000  286.0000000  326.0000000  372.0000000  335.0000000  381.0000000
  4488000.000    317.0000000  296.0000000  247.0000000  280.0000000  366.0000000  334.0000000  373.0000000  320.0000000
  4487000.000    305.0000000  290.0000000  381.0000000  300.0000000  256.0000000  286.0000000  305.0000000  375.0000000
```

FIGURE C-2. (Continued)

```
                              EXAMPLE SHORT TERM PROBLEM                                      DATE 040679, CASE  1, PAGE    3

                                                   TABLE    2 (CONT)

                                                - GENERAL INPUT DATA -

                                  *-* DISCRETE POINT TERRAIN HEIGHTS (METERS) *-*
   X         Y            HEIGHT            X         Y          HEIGHT               X         Y          HEIGHT
(METERS)  (METERS)                      (METERS)  (METERS)                        (METERS)  (METERS)
-------------------------------------------------------------------------------------------------------------------------

605167.0  4489107.0   274.0000000
```

FIGURE C-2. (Continued)

```
                                     EXAMPLE SHORT TERM PROBLEM                                                      DATE 040679, CASE  1, PAGE    4
                                                                     TABLE    3

                                                               - SOURCE INPUT DATA -

                                                            - SOURCE INVENTORY -
C T SOURCE T   SOURCE        X           Y       HEIGHT   IF TYPE=0      IF TYPE=0     ANGLE    STACK    ELEVATION   PARTICULATE DISTRIBUTION
A P NUMBER Y  STRENGTH   COORDINATE COORDINATE   ABOVE   TEMP (DEG K)  VOL. EMISS       TO     INNER        AT         SETTLING   FREQUENCY
R P        P(GRAMS/SEC)  (METERS)    (METERS)    GROUND  IF TYPE=1OR2  RT. M**3/SEC    LONG    RADIUS     STACK       VELOCITY       OF
D E        E                                    (METERS) LENGTH SHORT  IF TYPE=1OR2    SIDE   (METERS)     BASE     (METERS/SEC) OCCURRENCE
                                                          SIDE (MTRS)  LENGTH LONG    (DEG)              (METERS)                 (FRACTION)
                                                                        SIDE (MTRS)
--------------------------------------------------------------------------------------------------------------------------------------------
X       116 0    318.150  604380.00 4488740.00    67.10    472.000        160.980         0     2.600     229.00
X       117 0    318.150  604380.00 4488740.00    62.50    444.000        162.140         0     1.850     229.00
X       118 0   1260.000  602330.00 4487800.00   229.00    411.000        881.460         0     3.200     229.00
```

FIGURE C-2. (Continued)

```
                                  EXAMPLE SHORT TERM PROBLEM                                                        DATE 040679, CASE  1, PAGE    5

                                                                   TABLE    4

                                                        - METEOROLOGICAL INPUT DATA -

HOUR     WIND        WIND      LAYER    AMBIENT   VERT GRAD   STAB  WND SPD    STD DEV EL   STD DEV AZ   STD DEV EL   STD DEV AZ      LATERAL
       DIRECTION    SPEED      DEPTH      TEMP    OF POT TMP ILITY POWER LAW  ANGLE, SOR   ANGLE, SOR   ANGLE, SOR   ANGLE, SOR     DIFFUSION
      (DEGREES)  (MTR/SEC) (METERS)  (DEG K)   (DEG K/M)   CAT.  EXPONENT     TYPE 0       TYPE 0      TYPE 1OR2    TYPE 1OR2    COEFFICIENT
        THETA       UBAR        HM        TA        DPDZ    ISTBLE     P     SIGEPU(RAD) SIGAPU(RAD) SIGEPL(RAD) SIGAPL(RAD)       ALPHA
-----------------------------------------------------------------------------------------------------------------------------------------------
 100  170.0000     5.4017    953.000   283.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 200  190.0000     6.6878   1068.000   284.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 300  210.0000    10.0316   1184.000   285.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 400  220.0000     9.7744   1299.000   285.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 500  245.0000     8.2311   1415.000   283.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 600  255.0000     9.2630   1530.000   282.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 700  255.0000     9.7744   1645.000   280.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 800  250.0000    10.2889   1598.000   280.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
 900  250.0000     9.0028   1551.000   280.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1000  250.0000     8.4983   1504.000   279.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1100  250.0000     8.2311   1457.000   279.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1200  250.0000     7.2022   1410.000   279.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1300  250.0000     9.2630   1363.000   279.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1400  250.0000     7.7167   1316.000   278.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1500  255.0000     6.6878   1269.000   278.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1600  260.0000     6.1733   1221.000   277.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1700  260.0000     7.7167   1174.000   276.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1800  265.0000     6.6878   1127.000   276.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
1900  260.0000     7.7167   1080.000   275.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
2000  250.0000     6.6878   1033.000   275.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
2100  250.0000     5.9161    986.000   275.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
2200  240.0000     6.1733    939.000   275.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
2300  260.0000     6.1733    892.000   274.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
   0  270.0000     5.9161    845.000   274.000      .0000             .1700    .0735000     .1051000     .0735000     .1051000         .9000
```

FIGURE C-2. (Continued)

```
                              EXAMPLE SHORT TERM PROBLEM                                                    DATE 040679, CASE  1, PAGE    6

                                                              TABLE    5

                 1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES     116
                                                       - HOUR(S)  100 TO  100 -

                                                       - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS   247.3997192 AT X= 604000.0, Y=4490500.0)
                  602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)
                                                            -  CONCENTRATION  -
              --------------------------------------------------------------------------------------------------------------------------

  4497000.000     14.2223103   36.1061482    4.8805170     .5190239     .0241774     .0004504     .0000030     .0000000     .0000000
  4496000.000      7.8008422   46.9024491    7.7709170     .6940705     .0197872     .0001820     .0000005     .0000000     .0000000
  4495000.000      2.4095625   56.5384755   13.5737340     .9007707     .0144357     .0000492     .0000000     .0000000     .0000000
  4494000.000       .2571718   52.6516004   23.3759139    1.1663914     .0086095     .0000060     .0000000     .0000000     .0000000
  4493000.000       .0033553   24.5402713   47.7679605    1.6394942     .0031775     .0000002     .0000000     .0000000     .0000000
  4492000.000       .0000003    3.0994149  107.0097582    2.1492204     .0003859     .0000000     .0000000     .0000000     .0000000
  4491500.000       .0000000     .2516859  166.1096191    2.2946029     .0000525     .0000000     .0000000     .0000000     .0000000
  4491000.000       .0000000     .0026543  232.5167007    2.2064084     .0000019     .0000000     .0000000     .0000000     .0000000
  4490500.000       .0000000     .0000003  247.3997192    1.5866858     .0000000     .0000000     .0000000     .0000000     .0000000
  4490000.000       .0000000     .0000000   98.0614033     .4602311     .0000000     .0000000     .0000000     .0000000     .0000000
  4489500.000       .0000000     .0000000    1.9098921     .0023835     .0000000     .0000000     .0000000     .0000000     .0000000
  4489000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                                       - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS   247.3997192 AT X= 604000.0, Y=4490500.0)
                  607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)
                                                            -  CONCENTRATION  -
              --------------------------------------------------------------------------------------------------------------------------

  4497000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4496000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4495000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4494000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4493000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4492000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4491500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4491000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
```

FIGURE C-2. (Continued)

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                    EXAMPLE SHORT TERM PROBLEM                                              DATE 040679, CASE  1, PAGE    7

                                                         TABLE    5 (CONT)

              1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116
                                                  - HOUR(S)  100 TO  100 -

                                                 - DISCRETE POINT RECEPTORS -
                      (THE MAXIMUM CONCENTRATION IS,      .0000000 AT X= 605167.0, Y=4489107.0)
    X          Y        CONCENTRATION         X          Y        CONCENTRATION          X          Y        CONCENTRATION
(METERS)   (METERS)                       (METERS)   (METERS)                        (METERS)   (METERS)
-------------------------------------------------------------------------------------------------------------------------

605167.0  4489107.0       .0000000
```

FIGURE C-2. (Continued)

```
                         EXAMPLE SHORT TERM PROBLEM                                          DATE 040679, CASE  1, PAGE   12

                                              TABLE    8

             3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116
                                         - HOUR(S)  100 TO  300 -

                                       - GRID SYSTEM X AXIS (METERS) -
                         (THE MAXIMUM CONCENTRATION IS   212.4816704 AT X= 604500.0, Y=4489500.0)
          602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                     -  CONCENTRATION  -
      ----------------------------------------------------------------------------------------------------------------------

 4497000.000      4.7407727   12.0354823    1.7723003    1.6235925    6.4741411   13.1976879   12.6679630    6.0229012    1.5661217
 4496000.000      2.6002807   15.6341790    2.7500904    2.3444637    9.8801709   17.7214160   12.7093376    3.8222963    1.1440365
 4495000.000       .8031875   18.8461630    4.6886724    3.4875555   15.9967725   22.9399971   10.0380678    1.9306526    3.7723114
 4494000.000       .0857239   17.5505335    7.9459130    5.4956552   27.6283460   26.4457643    5.5204686    4.2594492   14.5965636
 4493000.000       .0011184    8.1800903   16.0489142   10.0029573   48.4546080   20.9225385    4.8959361   21.9452691   21.6877313
 4492000.000       .0000031    1.0331383   36.0075502   20.8357074   76.2983303    9.0963883   35.6333909   27.8724697    2.8982595
 4491500.000       .0000000     .0838953   55.4088225   32.5145583   79.7184935   17.9754260   56.8662443    8.2490150     .1537538
 4491000.000       .0000000     .0008848   77.5186110   55.0353184   59.8722153   71.5178204   27.7852600     .3707420     .0006735
 4490500.000       .0000000     .0000001   82.4681234  101.6858015   30.1720123  104.0021553    1.1524314     .0004670     .0000000
 4490000.000       .0000000     .0000000   32.6871157  195.4842758  183.9287453    5.6085743     .0001686     .0000000     .0000000
 4489500.000       .0000000     .0000000     .6366307  212.4816704   47.7809610     .0000053     .0000000     .0000000     .0000000
 4489000.000       .0000000     .0000000     .0000000   15.6786101     .0000000     .0000000     .0000000     .0000000     .0000000
 4488500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                       - GRID SYSTEM X AXIS (METERS) -
                         (THE MAXIMUM CONCENTRATION IS   212.4816704 AT X= 604500.0, Y=4489500.0)
          607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                     -  CONCENTRATION  -
      ----------------------------------------------------------------------------------------------------------------------

 4497000.000       .9641596    2.9497429    6.0609397    7.4470897    5.8309135    3.0764584     .3173889     .0115116
 4496000.000      3.3394006    7.7723649    9.4162207    6.5291564    2.7899826     .7895707     .0233365     .0002478
 4495000.000     10.4173508   12.1889882    7.0456988    2.2260994     .4277399     .0542967     .0003316     .0000008
 4494000.000     16.2332120    6.9785293    1.3962367     .1515219     .0100373     .0004483     .0000004     .0000000
 4493000.000      5.6933103     .5456014     .0241171     .0005952     .0000094     .0000001     .0000000     .0000000
 4492000.000       .0749598     .0007300     .0000036     .0000000     .0000000     .0000000     .0000000     .0000000
 4491500.000       .0007461     .0000015     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4491000.000       .0000004     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4490500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4490000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4489500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4489000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
```

FIGURE C-2. (Continued)

```
                          EXAMPLE SHORT TERM PROBLEM                                        DATE 040679, CASE  1, PAGE   13

                                                    TABLE    8 (CONT)

                   3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116
                                                - HOUR(S)  100 TO  300 -

                                              - DISCRETE POINT RECEPTORS -
                         (THE MAXIMUM CONCENTRATION IS.     .0000000 AT X= 605167.0, Y=4489107.0)
    X          Y        CONCENTRATION          X          Y        CONCENTRATION          X          Y       CONCENTRATION
 (METERS)   (METERS)                        (METERS)   (METERS)                        (METERS)   (METERS)
-------------------------------------------------------------------------------------------------------------------------

605167.0   4489107.0       .0000000
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                         DATE 040679, CASE  1, PAGE   70

                                                   TABLE   37

          24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116
                                               - HOUR(S)  100 TO    0 -

                                               - GRID SYSTEM X AXIS (METERS) -
                         (THE MAXIMUM CONCENTRATION IS   703.9800262 AT X= 605000.0, Y=4489000.0)
                602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                                   -  CONCENTRATION  -
               ---------------------------------------------------------------------------------------------------------------------

  4497000.000       .5925966    1.5044353     .2215375     .2029491     .8092676    1.5497110    1.5834954     .7528627     .1957653
  4496000.000       .3250351    1.9542724     .3437613     .2930580    1.2350214    2.2151770    1.5886672     .4777871     .1430094
  4495000.000       .1003984    2.3557704     .5860776     .4359444    1.9995966    2.8549996    1.2547585     .2413335     .4718228
  4494000.000       .0107155    2.1938167     .9932391     .6869569    3.4535432    3.3057205     .6900590     .5326697    1.8408720
  4493000.000       .0001398    1.0225113    2.0061180    1.2503697    6.0568260    2.6153173     .6121427    2.7726109    3.2921273
  4492000.000       .0000000     .1291423    4.5009438    2.6044634    9.5372913    1.1373488    4.5135794    5.2621849    4.8503484
  4491500.000       .0000000     .0104869    6.9261028    4.0643198    9.9648117    2.2496497    8.0388374    6.9329135    3.3992249
  4491000.000       .0000000     .0001106    9.6898264    6.8794149    7.4840292    9.0961775   10.4509133    5.5114490    1.1426097
  4490500.000       .0000000     .0000000   10.3085154   12.7107252    3.7723840   18.4789855   10.1667010    2.4862293   11.5944065
  4490000.000       .0000000     .0000000    4.0858932   24.4355345   23.5662365   23.2355189    8.7311997   36.0789213   71.5563993
  4489500.000       .0000000     .0000000     .0795788   26.5602088   54.1036777   31.3448625  176.5285397  192.4517326  123.8642540
  4489000.000       .0000000     .0000000     .0000000    2.0146030  703.9800262  490.3607445  222.5909233   96.9381027   57.1596508
  4488500.000       .0000000     .0000000     .0000000     .0000000     .0004179    1.1893189    5.6338416    7.7552179    6.6504030
  4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000022     .0006468     .0120165
  4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                               - GRID SYSTEM X AXIS (METERS) -
                         (THE MAXIMUM CONCENTRATION IS   703.9800262 AT X= 605000.0, Y=4489000.0)
                607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                                   -  CONCENTRATION  -
               ---------------------------------------------------------------------------------------------------------------------

  4497000.000       .1205286     .3690118     .7620260     .9642984     .8712342     .7558340     .8099805     .4795276
  4496000.000       .4177238     .9779699    1.2349757    1.0730993     .9768599    1.0377046     .6650561     .1539795
  4495000.000      1.3120892    1.6332824    1.3763445    1.3519496    1.3465432     .9755361     .1934250     .1341335
  4494000.000      2.2635725    1.8939367    1.9466137    1.5292838     .7423254     .2520653     .2905230    1.0955610
  4493000.000      2.9139365    2.5960234    1.2115985     .3447772     .2888296     .7725684    2.3680208    3.7935487
  4492000.000      2.2827418     .5253641     .9010517    2.4378248    4.1803587    5.7801704    9.8890212   13.5336242
  4491500.000       .7158907    1.8991510    4.7386709    7.4601717   10.3277736   14.0069797   19.1290677   17.5970662
  4491000.000      4.4013931    9.5842267   14.8854631   21.3618598   26.7578478   28.3180790   23.1287284   15.9462842
  4490500.000     22.4246893   36.0867000   45.3379955   44.9431529   38.2155601   30.4879930   19.2424331   13.2881503
  4490000.000     87.2355785   73.9471254   55.4492064   40.6045561   30.7199755   24.1053433   15.8505509   10.9282850
  4489500.000     77.3925276   55.7817783   39.3821301   29.2389314   21.9904919   16.8919060   10.5752736    7.1162280
  4489000.000     54.9213157   24.8580377   18.4491527   13.7789297   10.5927154    8.5642976    5.7936429    4.2427261
  4488500.000      5.9596484    5.3525183    5.1359760    4.4392172    3.9732603    3.5169147    2.7541972    2.2460218
  4488000.000       .0546511     .1355376     .2301332     .3511582     .4661966     .5462085     .6486202     .6044335
  4487000.000       .0000000     .0000000     .0000002     .0000041     .0000330     .0001659     .0014641     .0058392
```

FIGURE C-2. (Continued)

```
            EXAMPLE SHORT TERM PROBLEM                                        DATE 040679, CASE  1, PAGE   71

                                              TABLE   37 (CONT)

                 24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116
                                          - HOUR(S)  100 TO    0 -

                                          - DISCRETE POINT RECEPTORS -
                      (THE MAXIMUM CONCENTRATION IS,  719 1866608 AT X= 605167 0, Y=4489107 0)
    X          Y       CONCENTRATION          X          Y       CONCENTRATION          X          Y       CONCENTRATION
 (METERS)   (METERS)                      (METERS)   (METERS)                       (METERS)   (METERS)
 ---------------------------------------------------------------------------------------------------------------------

 605167 0  4489107 0   719 1866608
```

FIGURE C-2. (Continued)

```
                                  EXAMPLE SHORT TERM PROBLEM                                                                   DATE 040679, CASE  1, PAGE  136

                                                                      TABLE   70

                            24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    117
                                                              - HOUR(S)  100 TO    0 -

                                                        - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS   216.5489502 AT X= 605500.0, Y=4489000.0)
              602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                                  -  CONCENTRATION  -
       ----------------------------------------------------------------------------------------------------------------------------

 4497000.000      .0840319    1.4828681     .2146320     .1615757     .6289326    1.2922075    1.2360014     .5874409     .1554547
 4496000.000      .1203221    1.9250538     .3346516     .2346468     .9492638    1.7073395    1.2343281     .3717952     .1279577
 4495000.000      .0988631    2.3213537     .5734136     .3430335    1.5265016    2.1777638     .9569033     .1963368     .4586518
 4494000.000      .0105379    2.1602903     .9705463     .5254393    2.6471370    2.5434784     .5392775     .5246319    1.8347845
 4493000.000      .0001374    1.0073656    1.9604104     .9396770    4.6258528    1.9679569     .5648786    2.7292553    3.2509906
 4492000.000      .0000000     .1268465    4.3821508    1.8483866    6.9935567     .9255829    4.1460943    5.1488358    4.6970982
 4491500.000      .0000000     .0102633    6.7157514    2.7222326    6.9393477    1.9615822    7.6763523    6.7776830    3.3870119
 4491000.000      .0000000     .0001079    9.3189431    4.1925336    4.8390106    7.8298313    9.9173635    5.4485711     .9579414
 4490500.000      .0000000     .0000000    9.7613237    6.4423313    2.3080339   16.3799860    9.5169066    1.9119549    8.7906919
 4490000.000      .0000000     .0000000    3.7404203    7.9690865   13.3092383   19.9600125    6.1210333   27.0237508   59.4221773
 4489500.000      .0000000     .0000000     .0689246    1.8308713   16.7915251   12.9611959  109.0087004  138.9838448   95.1911421
 4489000.000      .0000000     .0000000     .0000000     .0000014   41.7861719  216.5489502  156.8865261   63.3540993   40.6658182
 4488500.000      .0000000     .0000000     .0000000     .0000000     .0000538     .5913664    3.8970625    6.0712986    4.8369637
 4488000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000016     .0004690     .0094726
 4487000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                                        - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS   216.5489502 AT X= 605500.0, Y=4489000.0)
              607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                                  -  CONCENTRATION  -
       ----------------------------------------------------------------------------------------------------------------------------

 4497000.000      .1150306     .3662504     .7521915     .9521829     .8637388     .7544966     .8096062     .4794332
 4496000.000      .4096698     .9619387    1.2152957    1.0632889     .9753861    1.0347221     .6647474     .1527773
 4495000.000     1.2995075    1.6006304    1.3666630    1.3436707    1.3420591     .9668281     .1903363     .1032363
 4494000.000     2.2527066    1.8883938    1.9192524    1.5154338     .7354193     .2462016     .2188369     .8372394
 4493000.000     2.9488642    2.5593245    1.1878786     .3303896     .2248273     .5794499    1.8587991    3.2477764
 4492000.000     2.2813593     .4903662     .6732080    1.8319353    3.2802408    4.7972036    8.9226865   12.3378198
 4491500.000      .6442607    1.4357456    3.6918703    6.1586229    8.8994645   12.5591805   17.4358852   15.9378595
 4491000.000     3.3892299    7.6257414   12.9622962   19.2873614   24.3718441   25.2739024   20.8776345   14.1755507
 4490500.000    18.4208648   32.0905504   40.6404958   40.7618117   34.1397152   27.0921819   16.6420274   11.2397178
 4490000.000    74.0384188   62.9497428   48.5969095   35.6160560   26.4699262   20.4154367   13.0948384    8.9330152
 4489500.000    59.6278582   46.1480713   31.5282731   23.8167477   17.8261421   13.5433327    8.4997034    5.6953782
 4489000.000    25.0575361   18.7355430   14.6462555   10.8235277    8.2445595    6.7851152    4.5713295    3.3774888
 4488500.000     4.3903976    4.0098249    3.9984177    3.4562322    3.1392827    2.9085026    2.1907502    1.7971480
 4488000.000      .0421779     .1047890     .1766928     .2744089     .3728106     .4362390     .5200516     .5465384
 4487000.000      .0000000     .0000000     .0000002     .0000032     .0000258     .0001311     .0011658     .0046918
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                              DATE 040679, CASE  1, PAGE  137

                                                  TABLE   70 (CONT)

            24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    117
                                               - HOUR(S)  100 TO    0 -

                                            - DISCRETE POINT RECEPTORS -
                   (THE MAXIMUM CONCENTRATION IS,  227.1074886 AT X= 605167.0, Y=4489107.0)
   X         Y        CONCENTRATION          X         Y        CONCENTRATION          X         Y       CONCENTRATION
(METERS)  (METERS)                        (METERS)  (METERS)                        (METERS)  (METERS)
          --------------------------------------------------------------------------------------------------------------

605167.0  4489107.0   227.1074886
```

FIGURE C-2. (Continued)

```
                         EXAMPLE SHORT TERM PROBLEM                                    DATE 040679, CASE  1, PAGE  202

                                                  TABLE  103

                   24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES     118
                                             - HOUR(S)  100 TO    0 -

                                               - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS    65.3337402 AT X= 606000.0, Y=4489000.0)
                602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                            -  CONCENTRATION  -
                -------------------------------------------------------------------------------------------------------------------

  4497000.000     .3135585    1.1191863    2.4490656    1.3766759     .4973230     .1563832     .2596275     .7094669    1.2697622
  4496000.000     .4302759    1.5197087    2.5337976    1.0875401     .2505514     .2450559     .7960196    1.5226557    1.7977774
  4495000.000     .5746676    2.3235413    2.3928742     .5726227     .2453908     .9452065    1.8052024    2.1243725    1.8221498
  4494000.000     .7817351    3.3899684    1.2991461     .2989897     .9876370    2.4715801    2.8515594    2.4768090    2.5305618
  4493000.000    1.2206616    3.7246657     .5328900     .9622639    3.2909908    3.4518573    3.0046349    3.2693051    2.3816875
  4492000.000    1.8315836    6.4932945     .7938400    3.6616580    4.4052404    4.3743318    3.1393561    1.5182316     .4137577
  4491500.000    2.0091381    5.8106378    2.0385590    4.4751847    4.5382963    3.7920206    1.7806584     .4056109     .8882243
  4491000.000    2.6643666    4.8580142    3.7374392    4.2439269    4.7512296    1.9459223     .5377122    1.4648927    3.9713055
  4490500.000    2.4568176    1.8521598    3.9000528    4.3490675    1.8716740     .6002146    2.3016237    6.6225058   10.9191364
  4490000.000    1.4772900     .6725178    3.3761511    1.7217980     .4834524    3.7874234   11.1454008   18.0665963   29.1677337
  4489500.000     .0689086     .5232657    2.1859979     .4017193    3.7743571   12.9386657   29.6033847   43.2896166   47.0940719
  4489000.000     .0000054     .6161549     .2956935    4.4699585   23.8142800   50.7727828   65.3337402   44.6827374   39.2613950
  4488500.000     .0000000     .0001355    2.7162903   12.3210129   29.6942935   35.0745873   39.9559903   41.1221089   24.6059806
  4488000.000     .0000000     .0000000     .2453974    1.8873233    7.8827643   17.9979925   18.0237982   12.8004684   14.4236330
  4487000.000     .0000000     .0000000     .0000000     .0000166     .0015617     .0189028     .0523162     .1466534     .3056920

                                               - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS    65.3337402 AT X= 606000.0, Y=4489000.0)
                607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                            -  CONCENTRATION  -
                -------------------------------------------------------------------------------------------------------------------

  4497000.000    1.5469316    1.3850722    1.1540450    1.1603681    1.2692304    1.2547478     .6689602     .1878145
  4496000.000    1.5470831    1.3814254    1.4639685    1.5267725    1.3030803     .8503116     .2135673     .1101341
  4495000.000    1.9263268    1.8645222    1.7182395    1.1378505     .5829594     .2401779     .1625607     .6553949
  4494000.000    2.4063321    1.6419387     .7519113     .2878908     .1623055     .2902087    1.1545380    2.3772530
  4493000.000    1.0286148     .3459023     .2472266     .5895131    1.2517195    2.1714131    3.8261296    5.7273144
  4492000.000     .6079070    1.5147752    2.7660537    4.0587488    5.4020941    6.9989449   11.7122269   15.7285770
  4491500.000    2.5406514    4.5690768    6.5648109    8.7079053   10.7004803   14.1991076   19.9845693   20.3642418
  4491000.000    6.6531228    9.6975408   14.7412014   19.3742023   23.5743787   23.9203082   25.0618186   20.4360569
  4490500.000   15.9164960   24.2240875   29.8472355   34.3427349   32.2480888   29.9619313   22.4375253   17.0262060
  4490000.000   37.3819194   39.6715283   40.8504991   37.8937535   31.9082441   26.6182694   19.3673470   15.5222533
  4489500.000   41.7538629   42.7590829   32.9928579   29.9174614   25.3606637   22.1635635   17.1780286   13.4967096
  4489000.000   30.9937510   28.7170558   28.5403774   22.9327352   18.6105753   17.1672928   12.4156636   10.0756751
  4488500.000   19.6042602   16.4967685   16.3191938   13.4202018   12.2871435   11.2340773    8.3089746    6.9537264
  4488000.000   11.0185345    9.3390170    7.5186907    7.3496169    7.6490277    6.7863038    5.7677466    4.6800396
  4487000.000     .3644797     .4713473     .7421011     .7505592     .7901295     .9259461    1.0948443    1.2843424
```

Figure C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                                DATE 040679, CASE  1, PAGE  203

                                                  TABLE  103 (CONT)

              24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES     118
                                                  - HOUR(S)  100 TO     0 -

                                                - DISCRETE POINT RECEPTORS -
                      (THE MAXIMUM CONCENTRATION IS,    32 5627375 AT X= 605167 0, Y=4489107 0)
    X          Y       CONCENTRATION           X          Y       CONCENTRATION           X          Y       CONCENTRATION
 (METERS)   (METERS)                        (METERS)   (METERS)                        (METERS)   (METERS)
 -----------------------------------------------------------------------------------------------------------------------

 605167 0  4489107 0     32.5627375
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM
                                                                         DATE 040679, CASE  1, PAGE  204
                                          TABLE  104

        1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117
                                  - HOUR(S)  100 TO  100 -

                                  - GRID SYSTEM X AXIS (METERS) -
                  (THE MAXIMUM CONCENTRATION IS   481.6692924 AT X= 604000.0, Y=4490500.0)
            602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)
                                                  - CONCENTRATION -
         ------------------------------------------------------------------------------------------------------------------

 4497000.000    28.2390833   71.6947479    9.6895538    1.0299641     .0479831     .0008941     .0000060     .0000000     .0000000
 4496000.000    15.4885716   93.1036720   15.4415944    1.3776181     .0392511     .0003609     .0000010     .0000000     .0000000
 4495000.000     4.7822778  112.2509527   26.9486160    1.7866953     .0286246     .0000975     .0000001     .0000000     .0000000
 4494000.000      .5100825  104.4985666   46.3231916    2.3110169     .0170705     .0000134     .0000000     .0000000     .0000000
 4493000.000      .0066527   48.5970454   94.5423946    3.2457393     .0062969     .0000004     .0000000     .0000000     .0000000
 4492000.000      .0000007    6.1437298  212.8362517    4.2440537     .0007629     .0000000     .0000000     .0000000     .0000000
 4491500.000      .0000000     .4980050  327.2120957    4.5193728     .0001035     .0000000     .0000000     .0000000     .0000000
 4491000.000      .0000000     .0052443  456.1486130    4.3267015     .0000037     .0000000     .0000000     .0000000     .0000000
 4490500.000      .0000000     .0000005  481.6692924    3.0845295     .0000000     .0000000     .0000000     .0000000     .0000000
 4490000.000      .0000000     .0000000  187.8314919     .8912449     .0000000     .0000000     .0000000     .0000000     .0000000
 4489500.000      .0000000     .0000000    3.5640936     .0042124     .0000000     .0000000     .0000000     .0000000     .0000000
 4489000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488500.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4487000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                  - GRID SYSTEM X AXIS (METERS) -
                  (THE MAXIMUM CONCENTRATION IS   481.5692924 AT X= 604000.0, Y=4490500.0)
            607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)
                                                  - CONCENTRATION -
         ------------------------------------------------------------------------------------------------------------------

 4497000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4496000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4495000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4494000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4493000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4492000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4491500.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4491000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4490500.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4490000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4489500.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4489000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488500.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4488000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
 4487000.000      .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                                DATE 040679, CASE  1, PAGE  205

                                                        TABLE  104 (CONT)

          1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117
                                                   - HOUR(S)  100 TO  100 -

                                                   - DISCRETE POINT RECEPTORS -
                    (THE MAXIMUM CONCENTRATION IS.      .0000000 AT X= 605167.0, Y=4489107.0)
    X          Y        CONCENTRATION          X          Y        CONCENTRATION          X          Y        CONCENTRATION
 (METERS)   (METERS)                        (METERS)   (METERS)                        (METERS)   (METERS)
          ----------------------------- ------------- ----------------------------------------------------------------------

605167.0   4489107.0        .0000000
```

FIGURE C-2. (Continued)

```
            EXAMPLE SHORT TERM PROBLEM                                                        DATE 040679, CASE  1, PAGE  210
                                                      TABLE  107
                3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117
                                               - HOUR(S)  100 TO  300 -

                                              - GRID SYSTEM X AXIS (METERS) -
                          (THE MAXIMUM CONCENTRATION IS   287.9301567 AT X= 605000.0, Y=4490000.0)
              602000.000    603000.000    604000.000    604500.000    605000.000    605500.000    606000.000    606500.000    607000.000
 Y AXIS (METERS)                                            - CONCENTRATION -
              ---------------------------------------------------------------------------------------------------------------------

  4497000.000    9.4130276   23.8994270    3.4693560    2.9161978   11.5048020   23.5353477   22.5559740   10.7224287    2.8097582
  4496000.000    5.1628572   31.0346096    5.4273333    4.2216380   17.4742811   31.3801322   22.5839620    6.7966574    2.1676596
  4495000.000    1.5940926   37.4169927    9.2761725    6.2318236   28.2087855   40.2621074   17.6932943    3.5013321    7.4393145
  4494000.000     .1700275   34.8328557   15.7102932    9.6991699   49.8054409   46.7935905    9.8346848    8.4546013   29.1449180
  4493000.000     .0022176   16.1990149   31.7322273   17.5203729   85.4614286   36.6661935    9.4138047   43.5477552   43.1081696
  4492000.000     .0000002    2.0479099   71.0648365   35.6227999  132.2467823   16.5026631   68.3687820   55.1579981    5.7065164
  4491500.000     .0000000     .1660016  109.1348433   54.2924185  135.2332764   33.6490579  111.1899815   16.3202784     .3070965
  4491000.000     .0000000     .0017481  152.0701561   88.5755863   98.5842848  133.0932140   54.1934032     .7376611     .0013447
  4490500.000     .0000000     .0000002  160.5587120  153.2244511   48.6314430  196.3852444    2.2319822     .0009306     .0000001
  4490000.000     .0000000     .0000000   62.6105080  259.2369728  287.9301567   10.4081122     .0003319     .0000000     .0000000
  4489500.000     .0000000     .0000000    1.1880279  227.1286392   67.7198563     .0000078     .0000000     .0000000     .0000000
  4489000.000     .0000000     .0000000     .0000000   15.6786211     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                              - GRID SYSTEM X AXIS (METERS) -
                          (THE MAXIMUM CONCENTRATION IS   287.9301567 AT X= 605000.0, Y=4490000.0)
              607500.000    608000.000    608500.000    609000.000    609500.000    610000.000    611000.000    612000.000
 Y AXIS (METERS)                                            - CONCENTRATION -
              ---------------------------------------------------------------------------------------------------------------------

  4497000.000    1.9843360    5.8774118   12.0437340   14.8008957   11.6123403    6.1478114     .6346558     .0230217
  4496000.000    6.6144149   15.4173965   18.6829057   12.9994997    5.5760438    1.5770029     .0466643     .0004956
  4495000.000   20.7348831   24.1353540   14.0430555    4.4390467     .8541190     .1081102     .0006614     .0000016
  4494000.000   32.3893399   13.9376910    2.7732223     .3016847     .0199862     .0008937     .0000007     .0000000
  4493000.000   11.2625532    1.0837570     .0477590     .0011834     .0000187     .0000002     .0000000     .0000000
  4492000.000     .1499196     .0014598     .0000372     .0000000     .0000000     .0000000     .0000000     .0000000
  4491500.000     .0014921     .0000030     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4491000.000     .0000008     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490500.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489500.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                                DATE 040679, CASE  1, PAGE  211

                                                      TABLE  107 (CONT)

                3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117
                                                  - HOUR(S)  100 TO  300 -

                                                  - DISCRETE POINT RECEPTORS -
                          (THE MAXIMUM CONCENTRATION IS,      .0000000 AT X= 605167.0, Y=4489107.0)
    X          Y       CONCENTRATION          X          Y       CONCENTRATION          X          Y       CONCENTRATION
 (METERS)   (METERS)                       (METERS)   (METERS)                       (METERS)   (METERS)
 ------------------------------------------------------------------------------------------------------------------------

 605167.0  4489107.0       .0000000
```

FIGURE C-2. (Continued)

```
         EXAMPLE SHORT TERM PROBLEM                                                    DATE 040679, CASE  1, PAGE  268

                                                    TABLE  136

                  24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117
                                                    - HOUR(S)  100 TO    0 -

                                            - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS   745.7661743 AT X= 605000.0, Y=4489000.0)
                   602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
 Y AXIS (METERS)
                                                             -  CONCENTRATION  -
              -------------------------------------------------------------------------------------------------------------

   4497000.000      1.1766285    2.9873034     .4361595     .3645247    1.4381002    2.9419185    2.8194968    1.3403036     .3512200
   4496000.000       .6453571    3.8793262     .6784129     .5277047    2.1842851    3.9225165    2.8229952     .8495822     .2709671
   4495000.000       .1992616    4.6771241    1.1595216     .7789779    3.5260982    5.0327634    2.2116618     .4376704     .9304745
   4494000.000       .0212534    4.3511070    1.9637954    1.2123962    6.1006801    5.9491980    1.2293365    1.0573017    3.6756565
   4493000.000       .0002772    2.0248769    3.9665284    2.1900466   10.6826786    4.5832742    1.1770213    5.5018662    6.5431179
   4492000.000       .0000000     .2559887    8.8831046    4.4528500   16.5309478    2.0629316    8.6596737   10.4110206    9.5474466
   4491500.000       .0000000     .0207502   13.6418542    6.7865523   16.9041595    4.2112318   15.7151897   13.7105964    6.7862369
   4491000.000       .0000000     .0002185   19.0087595   11.0719483   12.3230395   16.9260097   20.3682768   10.9600203    2.1005511
   4490500.000       .0000000     .0000000   20.0698190   19.1530564    6.0804179   34.9589711   19.6836076    4.3981842   20.3850985
   4490000.000       .0000000     .0000000    7.8263135   32.4046216   36.8754754   43.0955310   14.8522329   63.1026716  130.9785767
   4489500.000       .0000000     .0000000     .1485035   28.3910799   70.8952026   44.3060570  295.5372391  331.4355812  219.0553970
   4489000.000       .0000000     .0000000     .0000300    2.0146044  745.7661743  706.9096985  379.4774399  160.2922039   97.8254690
   4488500.000       .0000000     .0000000     .0000300     .0000000     .0004717    1.7806853    9.5309042   13.8265065   11.4873667
   4488000.000       .0000000     .0000000     .0000300     .0000000     .0000000     .0000000     .0000030     .0011158     .0214891
   4487000.000       .0000000     .0000000     .0000300     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000


                                            - GRID SYSTEM X AXIS (METERS) -
                                 (THE MAXIMUM CONCENTRATION IS   745.7661743 AT X= 605000.0, Y=4489000.0)
                   607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
 Y AXIS (METERS)
                                                             -  CONCENTRATION  -
              -------------------------------------------------------------------------------------------------------------

   4497000.000       .2355592     .7352623    1.5142175    1.9164813    1.7349730    1.5103306    1.6195867     .9589609
   4496000.000       .9273936    1.9399086    2.4502715    2.1363887    1.9522460    2.0724268    1.3298035     .3067567
   4495000.000      2.6115967    3.2339128    2.7430075    2.6956202    2.6886023    1.9423642     .3837613     .2373698
   4494000.000      4.3162791    3.7823306    3.8658561    3.0447175    1.4777447     .4982669     .5093599    1.9328004
   4493000.000      5.7628006    5.1553478    2.3994471     .6751668     .5136568    1.3520183    4.2268199    7.0413250
   4492000.000      4.5641014    1.0157303    1.5742597    4.2697601    7.4685995   10.5773741   18.8117077   25.8714437
   4491500.000      1.3601514    3.3348966    8.4305412   13.6187947   19.2272379   26.5661600   36.3649524   33.5349255
   4491000.000      7.6906221   17.2099679   27.8477492   40.6492214   51.1296921   53.5919814   44.0063620   30.1218352
   4490500.000     40.9455539   68.1772509   85.9784908   85.7049656   72.3553753   57.5801754   35.8844604   24.5270683
   4490000.000    161.2739964  136.8968697  104.0461149   76.2206125   57.1898017   44.5207801   28.9453888   19.8613002
   4489500.000    137.0203819  101.9238506   70.9104013   53.0556793   39.8166337   30.5352380   19.0749767   12.8116062
   4489000.000     59.9788523   43.5935802   33.0954185   24.6024575   18.8373747   15.3494128   10.3649724    7.6202149
   4488500.000     10.3500460    9.3623432    9.1344236    7.8954493    7.1125429    6.3254172    4.9449475    4.0431697
   4488000.000       .0968290     .2403266     .4068160     .6255671     .8390072     .9824465    1.1696717    1.2309719
   4487000.000       .0000000     .0000000     .0000004     .0000073     .0000588     .0002971     .0026299     .0105310
```

FIGURE C-2. (Continued)

```
              EXAMPLE SHORT TERM PROBLEM                                              DATE 040679, CASE  1, PAGE  269

                                                       TABLE  136 (CONT)

          24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -117    -
                                                - HOUR(S)  100 TO    0 -

                                                 - DISCRETE POINT RECEPTORS -
                              (THE MAXIMUM CONCENTRATION IS.  946.2941437 AT X= 605167.0, Y=4489107.0)
    X          Y       CONCENTRATION          X          Y       CONCENTRATION           X          Y       CONCENTRATION
(METERS)   (METERS)                       (METERS)   (METERS)                        (METERS)   (METERS)
 ---------------------------------------------------------------------------------------------------------------------------

605167.0  4489107.0   946.2941437
```

FIGURE C-2. (Continued)

```
                    EXAMPLE SHORT TERM PROBLEM                                          DATE 040679, CASE  1, PAGE  270

                                            TABLE  137

              1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                        - HOUR(S)  100 TO  100 -

                                       - GRID SYSTEM X AXIS (METERS) -
                        (THE MAXIMUM CONCENTRATION IS   481.6692924 AT X= 604000.0, Y=4490500.0)
              602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
 Y AXIS (METERS)
                                                  -  CONCENTRATION  -
          ----------------------------------------------------------------------------------------------------------------

 4497000.000    34.8815217   71.7422009    9.6895789   1.0299642    .0479831    .0008941    .0000060    .0000000    .0000000
 4496000.000    24.9495803   93.1398668   15.4415977   1.3776181    .0392511    .0003609    .0000010    .0000000    .0000000
 4495000.000    17.6009264  112.2796226   26.9486163   1.7866953    .0286246    .0000975    .0000001    .0000000    .0000000
 4494000.000    18.3654058  104.5145502   46.3231916   2.3110169    .0170705    .0000134    .0000000    .0000000    .0000000
 4493000.000    28.4737616   48.6016397   94.5423946   3.2457393    .0062969    .0000004    .0000000    .0000000    .0000000
 4492000.000    43.3755760    6.1450506  212.8362617   4.2440537    .0007629    .0000000    .0000000    .0000000    .0000000
 4491500.000    54.9825721     .4983008  327.2120957   4.5193728    .0001035    .0000000    .0000000    .0000000    .0000000
 4491000.000    63.6837993     .0052846  456.1486130   4.3267015    .0000037    .0000000    .0000000    .0000000    .0000000
 4490500.000    70.9433981     .0000015  481.6692924   3.0845295    .0000000    .0000000    .0000000    .0000000    .0000000
 4490000.000    35.4369545     .0000000  187.8314919    .8912449    .0000000    .0000000    .0000000    .0000000    .0000000
 4489500.000     1.6536784     .0000000    3.5640336    .0042124    .0000000    .0000000    .0000000    .0000000    .0000000
 4489000.000      .0001301     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4488500.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4488000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4487000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000    .0000000

                                       - GRID SYSTEM X AXIS (METERS) -
                        (THE MAXIMUM CONCENTRATION IS   481.6692924 AT X= 604000.0, Y=4490500.0)
              607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
 Y AXIS (METERS)
                                                  -  CONCENTRATION  -
          ----------------------------------------------------------------------------------------------------------------

 4497000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4496000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4495000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4494000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4493000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4492000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4491500.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4491000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4490500.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4490000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4489500.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4489000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4488500.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4488000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
 4487000.000      .0000000     .0000000     .0000000    .0000000    .0000000    .0000000    .0000000    .0000000
```

FIGURE C-2. (Continued)

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                    EXAMPLE SHORT TERM PROBLEM                                              DATE 040679, CASE  1, PAGE  271

                                                                  TABLE  137 (CONT)

                1 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                                         - HOUR(S)  100 TO  100 -

                                                        - DISCRETE POINT RECEPTORS -
                                  (THE MAXIMUM CONCENTRATION IS,      .0000000 AT X= 605167.0, Y=4489107.0)
     X          Y        CONCENTRATION           X          Y        CONCENTRATION           X          Y        CONCENTRATION
 (METERS)   (METERS)                          (METERS)   (METERS)                         (METERS)   (METERS)
     -----------------------------------------------------------------------------------------------------------------------------

 605167.0  4489107.0        .0000000
```

FIGURE C-2. (Continued)

```
                              EXAMPLE SHORT TERM PROBLEM                                                   DATE 040679, CASE  1, PAGE  276

                                                             TABLE  140

                    3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                                       - HOUR(S)  100 TO  300 -

                                                     - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS   287.9302254 AT X= 605000.0, Y=4490000.0)
                  602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)                                                   -  CONCENTRATION  -
                 ---------------------------------------------------------------------------------------------------------------

  4497000.000     11.9214952   32.8519158   23.0810420   13.9296052   15.4833858   24.7864063   24.6326780   16.3917785   12.8999026
  4496000.000      8.6050647   43.1842785   25.6976349   12.9219583   19.4786899   33.3403630   28.9451919   18.8835270   15.8955898
  4495000.000      6.1914330   56.0053225   28.4187665   10.8128047   30.1717863   47.0169196   32.0039439   19.4228315   17.6420584
  4494000.000      6.4239085   61.9526024   26.1033714   12.0110348   56.6994219   66.3508072   30.5231218   19.4775474   32.2793274
  4493000.000      9.7675103   45.9963408   35.9953346   25.2128944  111.4355650   60.2097335   18.1695037   45.1647491   43.2654572
  4492000.000     14.6526688   53.9942660   77.4123998   64.4149351  158.4658890   22.3660617   68.7776365   55.1762581    5.7068982
  4491500.000     18.4731052   46.6511040  125.3925586   86.5455799  146.0422935   34.4103465  111.2155027   16.3206520     .3070998
  4491000.000     21.3149328   38.8658614  181.2756342  106.3523216  100.1964245  133.1252251   54.1937079     .7376625     .0013447
  4490500.000     23.6545410   14.8172786  185.5193462  156.0432739   48.6718345  196.3854446    2.2319825     .0009306     .0000001
  4490000.000     11.8183200    5.3800962   67.5871925  259.2849655  287.9302254   10.4081122     .0003319     .0000000     .0000000
  4489500.000       .5512687    4.1810619    1.2735315  227.1286526   62.7198563     .0000078     .0000000     .0000000     .0000000
  4489000.000       .0000434    4.5808513     .0000004   15.6786211     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000       .0000000     .0000116     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000

                                                     - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS   287.9302254 AT X= 605000.0, Y=4490000.0)
                  607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)                                                   -  CONCENTRATION  -
                 ---------------------------------------------------------------------------------------------------------------

  4497000.000     13.8377913   15.3694867   17.3682945   17.1087151   12.4025868    6.3676609     .6436871     .0232200
  4496000.000     16.4542410   20.2799847   20.3890450   13.4582833    5.6720554    1.5923935     .0468998     .0004976
  4495000.000     24.9719577   25.2045858   14.2523674    4.4682071     .8573082     .1083827     .0006627     .0000016
  4494000.000     32.9345155   14.0018886    2.7783548     .3020139     .0200027     .0008944     .0000007     .0000000
  4493000.000     11.2716484    1.0841347     .0477901     .0011836     .0000187     .0000002     .0000000     .0000000
  4492000.000       .1499260     .0014598     .0000072     .0000000     .0000000     .0000000     .0000000     .0000000
  4491500.000       .0014921     .0000030     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4491000.000       .0000008     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4490000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4489000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488500.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4488000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
  4487000.000       .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000     .0000000
```

FIGURE C-2. (Continued)

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                      EXAMP:E SHORT TERM PROBLEM                                                  DATE 040679, CASE  1, PAGE  277

                                                        TABLE  140 (CONT)

                 3 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                                     - HOUR(S)  100 TO  300 -

                                                     - DISCRETE POINT RECEPTORS -
                          (THE MAXIMUM CONCENTRATION IS,      0000000 AT X= 605167 0, Y=4489107 0)
    X          Y       CONCENTRATION          X          Y       CONCENTRATION          X          Y       CONCENTRATION
 (METERS)   (METERS)                      (METERS)   (METERS)                       (METERS)   (METERS)
 ----------------------------------------------------------------------------------------------------------------------------

 605167 0  4489107 0      .0000000
```

FIGURE C-2. (Continued)

```
                 EXAMPLE SHORT TERM PROBLEM                                            DATE 040679, CASE  1, PAGE  334

                                                   TABLE  169

          24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                           - HOUR(S)  100 TO     0 -

                                        - GRID SYSTEM X AXIS (METERS) -
                      (THE MAXIMUM CONCENTRATION IS    769.5804596 AT X= 605000.0, Y=4489000.0)
             602000.000   603000.000   604000.000   604500.000   605000.000   605500.000   606000.000   606500.000   607000.000
Y AXIS (METERS)
                                                   -  CONCENTRATION  -
        -------------------------------------------------------------------------------------------------------------------

 4497000.000     1.4901869    4.1064896    2.8852352    1.7412007    1.9354232    3.0983017    3.0791243    2.0497705    1.6209821
 4496000.000     1.0756331    5.3980348    3.2122006    1.6152449    2.4348366    4.1675724    3.6190148    2.3722380    2.0687445
 4495000.000      .7739291    7.0006653    3.5523458    1.3516007    3.7714890    5.9779699    4.0168641    2.5620428    2.7526243
 4494000.000      .8029886    7.7440753    3.2629214    1.5013859    7.0883171    8.3207790    4.0808958    3.5341106    6.2062182
 4493000.000     1.2209398    5.7495426    4.4994183    3.1523104   13.9735695    8.0351313    4.1016562    8.7711712    8.9248053
 4492000.000     1.8315836    6.7492833    9.6769346    8.1145079   20.9363883    6.4372634   11.7990297   11.9292520    9.9612039
 4491500.000     2.3091381    5.8313880   15.6804131   11.2617369   21.4424553    8.0032524   17.4958479   14.1962066    7.6744608
 4491000.000     2.6643666    4.8582327   22.7462987   15.3156751   17.0742691   18.7719307   20.9059882   12.4249022    6.0710564
 4490500.000     2.9568176    1.8521598   23.9698915   23.5021236    7.9520917   35.4591842   21.9852304   11.0206898   31.3042350
 4490000.000     1.4772900     .6725178   11.2024745   34.1264186   37.3589253   46.9829498   25.9976337   81.1692581  160.1463108
 4489500.000      .0689086     .5232667    2.3345014   28.7927969   74.6695557   57.2447233  315.1406288  374.7251892  266.1494637
 4489000.000      .0000054     .6161549     .2956935    6.4945626  769.5804596  757.6824875  444.8111077  204.9749413  137.0868626
 4488500.000      .0000000     .0001355    2.7162903   12.3210129   29.6947649   36.9552728   49.4868937   54.9486156   36.0933471
 4488000.000      .0000000     .0000000     .2453974    1.8873233    7.8827643   17.9979925   18.0230020   12.8015942   14.4451220
 4487000.000      .0000000     .0000000     .0000000     .0000166     .0016617     .0189028     .0523162     .1466534     .3056920

                                        - GRID SYSTEM X AXIS (METERS) -
                      (THE MAXIMUM CONCENTRATION IS    769.5804596 AT X= 605000.0, Y=4489000.0)
             607500.000   608000.000   608500.000   609000.000   609500.000   610000.000   611000.000   612000.000
Y AXIS (METERS)
                                                   -  CONCENTRATION  -
        -------------------------------------------------------------------------------------------------------------------

 4497000.000     1.7824908    2.1203345    2.6682525    3.0768493    3.0042033    2.7650784    2.2885469    1.1467733
 4496000.000     2.3744766    3.3213340    3.9142400    3.6631607    3.2553262    2.9227383    1.5433707     .4168908
 4495000.000     4.4379235    5.0984349    4.4612470    3.8334709    3.2715617    2.1825419     .5463220     .8927646
 4494000.000     6.9226111    5.4247691    4.6177773    3.3326081    1.6400502     .7884756    1.6638979    4.3100533
 4493000.000     6.7914154    5.5012497    2.6466936    1.2646800    1.7653763    3.5234314    8.0529495   12.7686396
 4492000.000     5.1720083    2.5305054    4.3403134    8.3285089   12.8706937   17.5763190   30.5239341   41.6000214
 4491500.000     3.9008028    7.9039735   14.9953520   22.3266997   29.9277182   40.7652674   56.5495200   53.8991661
 4491000.000    14.3437448   26.9075086   42.5889506   60.0234237   74.7040710   77.4122896   69.0681801   50.5578914
 4490500.000    56.7620497   92.4013386  115.8257465  120.0476980  104.6034613   87.4421043   58.3219848   41.5540743
 4490000.000   198.6559124  176.5683956  144.8966345  114.1143627   89.0980453   71.1390486   48.3127356   35.3835535
 4489500.000   178.7742443  144.6879330  103.9032574   82.9731398   65.3772964   52.6988010   36.2530050   26.3083158
 4489000.000    90.9726019   72.3106356   61.6357951   47.5351925   37.4559503   32.5167050   22.7806356   17.6958902
 4488500.000    29.9543056   25.8591118   25.4536176   21.3156509   19.3996863   17.5594947   13.2539219   10.9968960
 4488000.000    11.1153635    9.5793436    7.9254966    7.9751840    9.4880348    7.7687552    6.9364184    5.9110116
 4487000.000      .3644797     .4713473     .7421015     .7505664     .7901884     .9262431    1.0974742    1.2948734
```

FIGURE C-2. (Continued)

```
              EXAMP.E SHORT T-RM PROBLEM
                                                                        DATE 040679, CASE  1, PAGE  335
                                             TABLE  169 (CONT)
        24 HOUR GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) FROM SOURCES    116   -118
                                          - HOUR(S)  100 TO    0 -

                                           - DISCRETE POINT RECEPTORS -
                     (THE MAXIMUM CONCENTRATION IS.  978.8568726 AT X= 605167.0, Y=4489107.0)
     X          Y       CONCENTRATION          X          Y        CONCENTRATION          X          Y        CONCENTRATION
 (METERS)   (METERS)                       (METERS)   (METERS)                        (METERS)   (METERS)
 ---------------------------------------------------------------------------------------------------------------------------

 605167.0  4489107.0    978.8568726
```

FIGURE C-2. (Continued)

e. Card Group 4 - This card group shows three cards defining the X (east-west) axis of the receptor grid system in UTM coordinates. The remaining cards of this group in Figure C-1 are omitted from the input deck.

f. Card Group 4a - This card group shows the UTM X (east-west) coordinate of the SO_2 monitor located to the east-northeast of the West Penn Power Plant. Only one data card is used from this card group.

g. Card Group 5 - This card group shows three cards defining the Y (north-south) axis of the receptor grid system in UTM coordinates. Only three cards from this group are included in the input deck.

h. Card Group 5a - This card group shows the UTM Y (north-south) coordinate of the SO_2 monitor site. Only one card from this group is used.

i. Card Group 5b - This card group shows the elevation in meters of each intersection of the X and Y axes of the grid system. There are a total of 45 cards included in this card group.

j. Card Group 5c - This card group shows one data card with the elevation of the SO_2 monitor site. The remaining cards shown in this group should be ignored.

k. Card Group 6 - Card Group 6 gives special model and control parameters. The value of TK is not punched because we are using the default concentration and source emission units. The parameters UTMX and UTMY default to 0, G defaults to 9.8, ZR defaults to 6.096, while GAMMA1, GAMMA2, DECAY and XRY default to .6, .66, 0 and 50, respectively.

l. Card Group 7 - Card Group 7 defines the number of source identification numbers used to define each source combination. Because

NGROUP equals "5", five values are punched in this card group and each value punched for this example uses only "1" source to identify the combination desired.

m. Card Group 8 - This card group gives the source identification numbers used to form each combined source output. The card shows Sources 116, 117 and 118 are to be printed individually, 116 and 117 are to be combined and 116 through 118 are to be combined. Only one data card is used from this group.

n. Card Group 9 - Card Group 9 is omitted from the input deck, because ISW(12) equals "0".

o. Card Group 9a - This card group shows the primary source input data and consists of three data cards for Card Group 9a. Also, Card Group 10 is omitted from the input deck because NS on all cards in Card Group 9a is "0". However, if Card Group 10 is input, each card(s) should immediately follow its respective source card (9a) in the input deck.

p. Card Group 11 - Card Group 11 shows the 24 hours of meteorological data input to the program. The value for DPDZ for each hour is "0" and the value of ALPHA for each hour defaults to "0.9".

q. Card Group 12 - This card group (not shown in Figure C-1) is omitted from the input deck because JFLG on each input source card is "0" (blank).

C.2.2 Run Time Required Data Storage and Page Output Estimate

The run time and page output estimate calculated for the short-time concentration run are given in the following paragraphs.

a. Run Time - The run time estimate is calculated using Equation (3-3) in Section 3.2.5 and is approximated by

$$\begin{aligned} \text{Time (Seconds)} \cong \Big\{ & \Big[N_s \cdot (\text{NXPNTS} \cdot \text{NYPNTS} + \text{NXWYPT}) \cdot \text{NHOURS} \\ & \cdot \text{NDAYS} \Big] \cdot 3.1 \times 10^{-3} + \Big[(I + J + K) \\ & \cdot (\text{NXPNTS} \cdot \text{NYPNTS} + \text{NXWYPT}) \cdot \text{NHOURS} \cdot \text{NDAYS} \Big] \\ & \cdot 2.2 \times 10^{-3} \Big\} \end{aligned} \tag{C-1}$$

Substituting values from Figure C-1,

$$\begin{aligned} \text{Time (Seconds)} & \cong \Big\{ \Big[3 \cdot (17 \cdot 15 + 1) \cdot 24 \cdot 1 \Big] \cdot 3.1 \times 10^{-3} + \\ & \quad \Big[(0 + 0 + 8) \cdot (17 \cdot 15 + 1) \cdot 24 \cdot 1 \Big] \cdot \\ & \quad 2.2 \times 10^{-3} \Big\} \\ & \cong 57.1 + 108.1 \\ & \cong 165.1 \end{aligned} \tag{C-2}$$

The actual run time was 120 seconds. The values of f (3.1×10^{-3}) and g (2.2×10^{-3}) are taken from worst case short-term runs and may often overestimate the actual run time.

b. Required Data Storage - The required data storage must be calculated to determine whether or not the desired run will fit in the SHORTZ program. The amount of data storage required by a particular run is determined by Equation (3-1) in Section 3.1.2. Taking values from Figure

C-1 and substituting in Equation (3-1) we calculate

$$12000 \geq (17 + 15 + 2 \cdot 1) + 6 \cdot (17 \cdot 15 + 1)$$

$$\geq 1570$$

We see from the calculated inequality that we are well within the program storage limitation.

c. Page Output - The page output estimate is calculated using Equation (3-4) in Section 3.2.5 and is approximated by

$$\text{Pages} \cong \underline{A} + \underline{B} + \underline{C} \qquad \text{(C-3)}$$

where A from Equation (3-5) is given by

$$\begin{aligned} \underline{A}^{*} &= \Bigg(1 + \left\{ \left[\frac{17}{9}\right] \cdot \left[\frac{15}{38}\right] + \left[\frac{1}{138}\right] \right\} \cdot 1 + \left[\frac{3}{44}\right] \cdot 1 \\ &\quad + \left[\frac{24 \cdot 1}{1 \cdot 40}\right] \cdot 1 \cdot 0 \Bigg) \qquad \text{(C-4)} \\ &= \Big(1 + \left\{2 \cdot 1 + 1\right\} \cdot 1 + 1 \cdot 1 + 1 \cdot 1 \cdot 0\Big) \\ &= 5 \end{aligned}$$

and B from Equation (3-6) is given by

$$\begin{aligned} \underline{B} &= (24 + 8 + 1 + 0) \cdot 5 \cdot \left(\left[\frac{17}{9}\right] \cdot \left[\frac{15}{43}\right] + \left[\frac{1}{129}\right]\right) \qquad \text{(C-5)} \\ &= 33 \cdot 5 \cdot 3 \\ &= 495 \end{aligned}$$

---

*The [ ] symbols indicate to round up to the next larger integer if there is any fractional part.

and $\underline{C}$ from Equation (3-6) is given by

$$\underline{C} = 4$$

giving a total of

$$\text{Pages} \cong 504$$

This estimate assumes the maximum number of output pages possible. The actual number of pages output for this example problem was 339 pages.

C.2.3 Example Print Output

Figure C-2 illustrates the printed concentration output for the short-term example problem. The listing begins by printing the input data under the heading "-GENERAL INPUT DATA-". This part of the output listing includes all punched data and default values, except source and meteorological data. Next, the source data are listed under the heading "-SOURCE INPUT DATA-". The meteorological data are then printed under the heading "-METEOROLOGICAL INPUT DATA-". The rest of the output listing consists of selected concentration tables. The entire output listing is not shown here due to it's size (339 pages). The page number shown in the upper right-hand corner of each page in Figure C-2 gives the position in the output listing of the illustrated table. For example, pages 6 and 7 (upper right-hand corner) show the hourly ground-level SO_2 concentrations due to Source 116 at 0100 hours. Pages 12 and 13 show the average 3-hour ground-level SO_2 concentrations due to Source 116 for the period 0100 to 0300 hours and pages 70 and 71 show the average 24-hour ground-level SO_2 concentrations due to Source 116.

APPENDIX D

EXAMPLE EXECUTION OF THE LONG-TERM MODEL (LONGZ) COMPUTER PROGRAM

D.1 INTRODUCTION

The following example problem uses the long-term (LONGZ) program to model the hypothetical aluminum reduction plant described in Section 2.6.2. The example problem calculates seasonal and annual average ground-level particulate concentrations. This appendix assumes the user is familiar with the example hypothetical aluminum reduction plant discussed in Section 2.6.2 of the main body of the text.

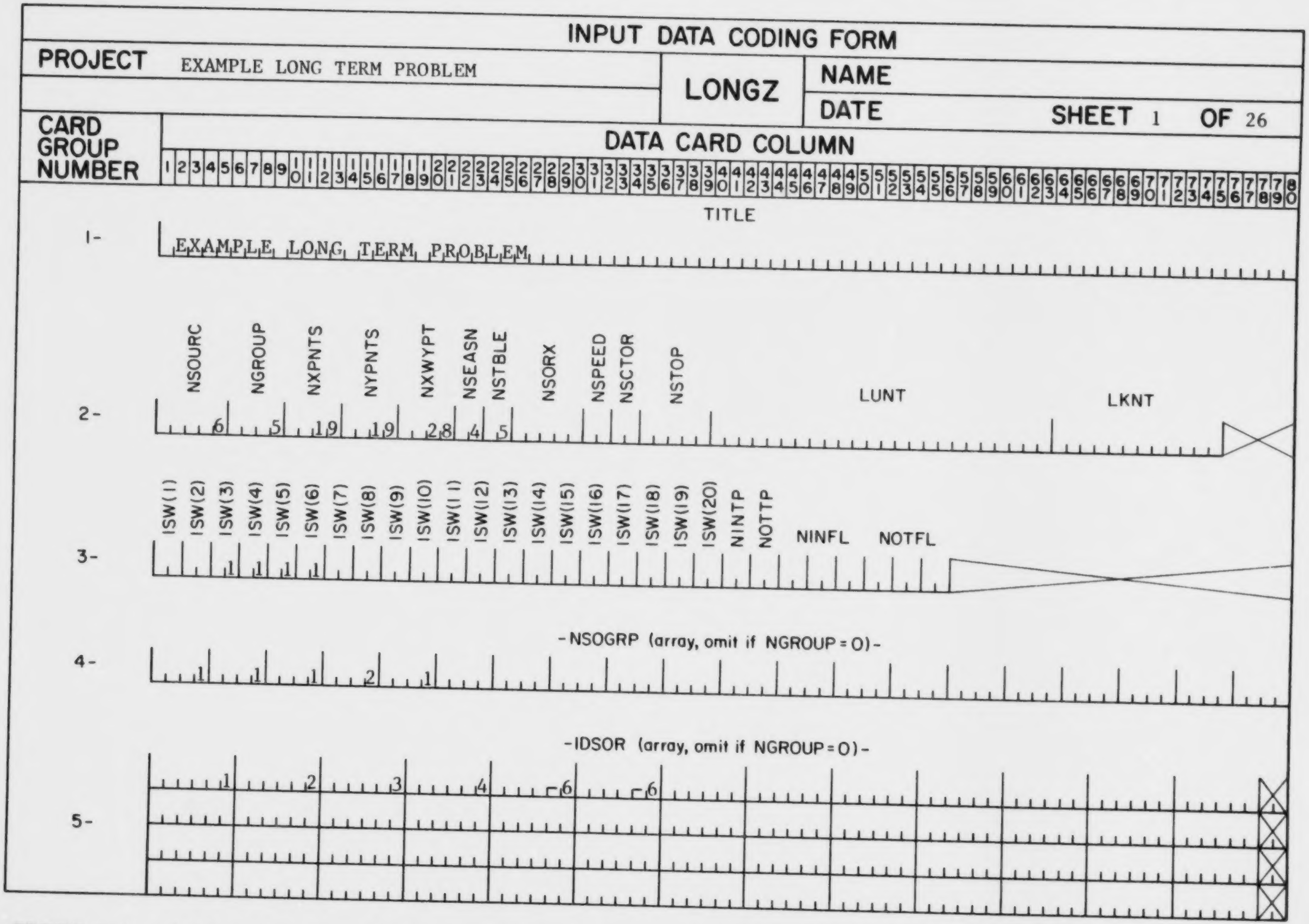
D.2 EXAMPLE CONCENTRATION RUN

This program example run calculates seasonal and annual average ground-level particulate concentrations produced by emissions from the hypothetical aluminum reduction plant described in Section 2.6.2 and shown in Figure 2-6. The hypothetical plant is modeled as six sources, three stack sources and three building sources. The meteorological inputs, as well as required program control data, run time estimate, and page output estimate are explained in Sections D.2.1 through D.2.3 below.

D.2.1 Input Data Set-Up Procedure

This example run requires the input data shown in the example coding forms in Figure D-1. An explanation of each card group in Figure D-1 is given in Sections D.2.1.a through D.2.1.r below.

a. Card Group 1. Card Group 1 gives the user selected title for the program run. This title is printed at the top of each output page as shown in Figure D-2.



INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 1 OF 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1- TITLE

EXAMPLE LONG TERM PROBLEM

2- NSOURC 6, NGROUP 5, NXPNTS 19, NYPNTS 19, NXWYPT 28, NSEASN 4, NSTBLE 5, NSORX, NSPEED, NSCTOR, NSTOP, LUNT, LKNT

3- ISW(1), ISW(2), ISW(3) 1, ISW(4) 1, ISW(5) 1, ISW(6) 1, ISW(7), ISW(8), ISW(9), ISW(10), ISW(11), ISW(12), ISW(13), ISW(14), ISW(15), ISW(16), ISW(17), ISW(18), ISW(19), ISW(20), NINTP, NOTTP, NINFL, NOTFL

4- -NSOGRP (array, omit if NGROUP = 0)-

1 1 1 2 1

5- -IDSOR (array, omit if NGROUP = 0)-

1 2 3 4 -6 -6

FIGURE D-1. Coding form for the example LONGZ problem.

PROJECT EXAMPLE LONG TERM PROBLEM

INPUT DATA CODING FORM

CARD GROUP NUMBER

LONGZ

NAME

DATE

DATA CARD COLUMN

SHEET 2 **OF** 26

- X (axis of grid system, omit if NXPNTS = 0 or ISW(1) = 1 or 2) -

6-	-3000	-2000	-1500	-1200	-1000	-800	-600	-400
	-200	0	200	400	600	800	1000	1200
	1500	2000	3000					

- X (arbitrarily placed receptors, omit if NXWYPT = 0 or ISW(1) = 1 or 2) -

6a-	-800	-600	-400	-200	0	200	400	600
	800	800	800	800	800	800	800	600

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 3 OF 26

CARD GROUP NUMBER	DATA CARD COLUMN 1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
	-X (arbitrarily placed receptors, continued) -							
6a - (Cont.)	400	200	0	-200	-400	-600	-800	-800
	-800	-800	-800	-800				
	- Y (axis of grid system, omit if NYPNTS = 0 or ISW(1) = 1 or 2) -							
7-	-3000	-2000	-1500	-1200	-1000	-800	-600	-400
	-200	0	200	400	600	800	1000	1200
	1500	2000	3000					

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 4 **OF** 26

CARD GROUP NUMBER	DATA CARD COLUMN 1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
	- Y (axis of grid system, continued) -							
7- (Cont.)								
	- Y (arbitrarily placed receptors, omit if NXWYPT = 0 or ISW(I) = 1 or 2) -							
7a-	700	700	700	700	700	700	700	700
	700	500	300	100	-100	-300	-500	-500
	-500	-500	-500	-500	-500	-500	-500	-300
	-100	100	300	500				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM	LONGZ	NAME	
		DATE	SHEET 5 OF 26

CARD GROUP NUMBER — DATA CARD COLUMN 1–80

- FMT (omit if ISW(1) = 1 or ISW(11) = 0) -

8- -OMIT-

- FREQ (omit if ISW(1) = 1) -

Card Group	Columns 1–10		
*8a-	.000286	N	Stability Category A, Winter
	.000286	NNE	
	.000286	NE	
	.000286	ENE	
	.000286	E	
	.000286	ESE	
	.000286	SE	
	.000286	SSE	
	.000286	S	
	.000286	SSW	
	.000286	SW	
	.000286	WSW	
	.000286	W	
	.000286	WNW	
	.000286	NW	
	.000286	NNW	

* This form shows the default format for Card Group 8a.

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 6 OF 26

CARD GROUP NUMBER

DATA CARD COLUMN

- FREQ (Continued) -

8a - (Cont.)	.0000000						Stability Category B, Winter
	.0002289	.0004579					
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0006868						
	.0006868						
	.0002289	.0004579					
	.0000000						
	.0000000						
	.0000872	.0004579	.0009158				Stability Category C, Winter
			.0004579				
			.0004579				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 7 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

8a - (Cont.)	.0010902		.0004579				Stability Category C, Winter (Cont.)
	.0006323	.0004579					
	.0000872	.0004579					
	.0000872	.0004579	.0009158				
	.0010902		.0004579				
	.0001744	.0009158	.0022894				
			.0009158				
			.0022894				
	.0000872	.0004579	.0050366				
	.0004361	.0022894	.0036630				
	.0001744	.0009158	.0022894				
	.0006323	.0004579	.0009158				
			.0013736				
	.0017899	.0054945	.0242674	.0082418	.0009158		Stability Category D, Winter
	.0024836	.0009158	.0041209				
	.0000833	.0013736	.0027473				
	.0001110	.0018315	.0027473				
	.0014153	.0073260	.0064103				
	.0018176	.0059524	.0054945				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 8 OF 26

DATA CARD COLUMN

- FREQ (Continued) -

CARD GROUP NUMBER	1–10	11–20	21–30	31–40	41–50	51–60	61–80
8a- (Cont.)	.0032329	.0132784	.0146520	.0041209			Stability Category D, Winter (Cont.)
	.0004995	.0082418	.0219780	.0018315			
	.0031496	.0119048	.0329670	.0114469	.0018315		
	.0007354	.0041209	.0201465	.0128205	.0009158		
	.0007354	.0041209	.0311355	.0375458	.0068681	.0004579	
	.0002775	.0045788	.0320513	.0453297	.0082418		
	.0007076	.0036630	.0434982	.0741758	.0141941	.0032051	
	.0009296	.0073260	.0187729	.0352564	.0178571	.0009158	
	.0004995	.0082418	.0233516	.0233516	.0096154	.0013736	
	.0003053	.0050366	.0274725	.0201465	.0018315		
	.0004006	.0036631	.0041209				Stability Categories E & F Winter
	.0006582	.0009158	.0004579				
	.0004006	.0045788					
	.0005914	.0004579	.0004579				
	.0028331	.0132784					
	.0019746	.0054946					
	.0052751	.0173993	.0004579				
	.0042258	.0164835	.0027473				
	.0045501	.0187729	.0059524				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 9 **OF** 26

- FREQ (Continued) -

CARD GROUP NUMBER	DATA CARD COLUMN						
8a - (Cont.)	.0013927	.0073260	.0054945				Stability Categories E & F Winter (Cont.)
	.0006677	.0064103	.0091575				
	.0020509	.0096154	.0068681				
	.0017170	.0054946	.0073260				
	.0007917	.0032051	.0022894				
	.0003339	.0032052	.0027473				
	.0000668	.0013737	.0027473				
	.0001006	.0004529					Stability Category A, Spring
	.0005535						
	.0000000						
	.0002013	.0009058					
	.0002013	.0009058					
	.0000000						
	.0001006	.0004529					
	.0001006	.0004529					
	.0000000						
	.0000000						
	.0000000						
	.0000000						

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 10 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

8a - (Cont.)	.0000000						Stability Category A, Spring (cont.)
	.0000000						
	.0000000						
	.0000535						
	.0005338	.0018116	.0031703				Stability Category B, Spring
	.0000323	.0009058	.0009058				
	.0000485	.0013587					
	.0000485	.0013587	.0009058				
	.0000323	.0009058					
	.0005014	.0009058	.0004529				
	.0014881	.0022645					
	.0014396	.0009058	.0009058				
	.0000970	.0027174	.0013587				
	.0004852	.0004529	.0004529				
	.0000162	.0004529	.0004529				
	.0000323	.0009058	.0009058				
	.0000809	.0022645	.0009058				
	.0000323	.0009058	.0018116				
	.0000647	.0018116	.0004529				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 11 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

8a - (Cont.)	.0000485	.0013587	.0009058				Stability Category B, Spring (cont.)
	.0002964	.0027174	.0072464				Stability Category C, Spring
			.0018116				
	.0001482	.0013587	.0004529				
	.0006011	.0009058	.0004529				
	.0003953	.0036232	.0013587				
	.0011528	.0013587	.0036232				
	.0008976	.0036232	.0027174	.0004529			
	.0000988	.0009058	.0031703				
	.0011528	.0013587	.0054348				
	.0005517	.0004529	.0022645		.0004529		
	.0006505	.0013587	.0027174	.0004529	.0009058		
	.0000494	.0004529	.0081522	.0018116			
	.0001482	.0013587	.0099638	.0004529			
	.0001482	.0013587	.0072464	.0004529			
	.0000494	.0004529	.0045290	.0018116	.0009058		
			.0045290				Stability Category D, Spring
	.0001703	.0049819	.0221920	.0194746	.0013587		
	.0000465	.0013587	.0067935	.0009058			

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 12 **OF** 26

CARD GROUP NUMBER — **DATA CARD COLUMN**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

CARD GROUP NUMBER							
8a - (Cont.)	.0000929	.0027174	.0027174				Stability Category D, Spring (Cont.)
	.0000619	.0018116	.0058877	.0004529			
	.0001239	.0036232	.0140399	.0004529			
	.0000774	.0022645	.0108696	.0027174			
	.0006232	.0045290	.0172101	.0027174			
	.0005768	.0031703	.0099638	.0027174	.0004529		
	.0001394	.0040761	.0163043	.0126812	.0018116		
	.0004839	.0004529	.0135870	.0122283	.0018116		
	.0001084	.0031703	.0307971	.0226449	.0018116		
	.0001239	.0036232	.0235507	.0384964	.0049819	.0018116	
	.0001239	.0036232	.0249094	.0434783	.0140399	.0040761	
	.0006232	.0045290	.0194746	.0285326	.0086051	.0004529	
	.0010761	.0040761	.0194746	.0375906	.0090580	.0018116	
	.0000774	.0022645	.0172101	.0185688	.0031703		
	.0008156	.0045290	.0153986				Stability Categories E & F, Spring
	.0022908	.0022645	.0018116				
	.0037792	.0049819					
	.0005826	.0049819	.0013587				
	.0053972	.0140399	.0004529				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 13 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

- FREQ (Continued) -

8a - (Cont.)	.0043486	.0076993	.0004529				Stability Categories E & F, Spring (Cont.)
	.0057073	.0067935					
	.0050345	.0090580	.0018116				
	.0072088	.0149457	.0067935				
	.0006859	.0058877					
	.0027437	.0076993					
	.0020709	.0086051	.0054348				
	.0074813	.0144928	.0054348				
	.0051905	.0131341	.0036232				
	.0057336	.0072464	.0067935				
	.0020709	.0040761	.0045290				
	.0000394	.0009058					Stability Category A, Summer
	.0005120	.0009058					
	.0000394	.0009058					
	.0000197	.0004529					
	.0000197	.0004529					
	.0004726						
	.0000197	.0004529					
	.0000000						

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 14 **OF** 26

DATA CARD COLUMN 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

CARD GROUP NUMBER							
8a - (Cont.)	.0000000						Stability Category A, Summer (Cont.)
	.0000000						
	.0000985	.0022645					
	.0000197	.0004529					
	.0000591	.0013587					
	.0000197	.0004529					
	.0000394	.0009058					
	.0000000						
	.0015783	.0058877	.0040761				Stability Category B, Summer
	.0005078	.0013587	.0004529				
	.0005078	.0013587	.0004529				
	.0010019	.0022645	.0013587				
	.0000961	.0031703	.0009058				
	.0005627	.0031703	.0022645				
	.0010430	.0036232	.0009058				
	.0024704	.0045290	.0027174				
	.0034448	.0058877	.0031703				
	.0005078	.0013587	.0009058				
	.0000549	.0018116	.0013587				

FIGURE D-1. (Continued)

PROJECT EXAMPLE LONG TERM PROBLEM

INPUT DATA CODING FORM

CARD GROUP NUMBER

LONGZ

NAME

DATE

DATA CARD COLUMN

SHEET 15 **OF** 26

- FREQ (Continued) -

8a - (Cont.)	.0005764	.0036232	.0031703				Stability Category B, Summer (Cont.)
	.0005746	.0036232	.0018116				
	.0000549	.0018116	.0009058				
	.0000823	.0027174	.0031703				
	.0000686	.0022645	.0013587				
	.0002882	.0031703	.0049819				
	.0007411	.0027174	.0031703				
	.0001235	.0013587	.0009058				Stability Category C, Summer
	.0000823	.0009058	.0031703	.0004529			
	.0006588	.0018116	.0072464	.0018116			
	.0006588	.0018116	.0009058				
	.0007411	.0027174	.0013587				
	.0018939	.0045290	.0013587				
	.0013587	.0040761	.0063406				
			.0040761				
	.0001647	.0018116	.0058877	.0009058			
	.0004117	.0045290	.0076993	.0027174			
	.0013999	.0045290	.0122283	.0036232	.0004529	.0004529	
	.0002059	.0022645	.0072464	.0031703	.0004529		

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 16 **OF** 26

CARD GROUP NUMBER | **DATA CARD COLUMN**

- FREQ (Continued) -

CARD GROUP NUMBER							
8a - (Cont.)	.0005764	.0009058	.0072464	.0004529			Stability Category C, Summer (Cont.)
	.0006588	.0018116	.0049819	.0004529			
	.0012236	.0081522	.0199275	.0045290		.0009058	Stability Category D Summer
	.0001430	.0040761	.0027174				
	.0002066	.0058877	.0022645				
	.0002702	.0076993	.0067935				
	.0015335	.0036232	.0063406	.0009058			
	.0005482	.0022645	.0018116	.0004529			
	.0011759	.0067935	.0022645				
	.0016765	.0076993	.0058877				
	.0032100	.0113225	.0122283	.0013587			
	.0015812	.0049819	.0113225	.0031703			
	.0004450	.0126812	.0253623	.0163043			
	.0017401	.0095109	.0357790	.0135870	.0009058		
	.0014143	.0135870	.0221920	.0131341	.0013587		
	.0002225	.0063406	.0095109	.0067935			
	.0007230	.0072464	.0176630	.0045290	.0004529		
	.0006436	.0049819	.0194746	.0131341			
	.0075765	.0131341	.0081522				Stability Categories E & F, Summer

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 17 **OF** 26

CARD GROUP NUMBER	DATA CARD COLUMN 1–10	11–20	21–30	31–40	41–50	51–60	61–80
	- FREQ (Continued) -						
8a - (Cont.)	.0049205	.0063406					
	.0016965	.0022645					
	.0043371	.0049819					
	.0097105	.0113225	.0013587				
	.0034697	.0027174	.0004529				
	.0144083	.0104167	.0004529				
	.0118061	.0104167	.0009058				Stability Categories E & F, Summer (Cont.)
	.0086742	.0158515	.0013587				
	.0049589	.0104167	.0013587				
	.0042987	.0104167	.0031703				
	.0115374	.0203805	.0018116				
	.0166882	.0126812	.0040761				
	.0146693	.0140399	.0009058				
	.0108772	.0167573	.0036232				
	.0039763	.0099638	.0058877				
	.0000000						Stability Category A, Fall
	.0000000						
	.0000000						
	.0000000						

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE **SHEET** 18 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

8a - (Cont.)	.0000000						Stability Category A, Fall (Cont.)
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0009158						
	.0000000						
	.0000000						
	.0000000						
	.0000000						
	.0000241	.0004579	.0004579				Stability Category B, Fall
	.0005061	.0004579	.0004579				
	.0005302	.0009158	.0009158				
	.0009639						
	.0000723	.0013736					
	.0009880	.0004579					
	.0005784	.0018315	.0004579				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 19 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FREQ (Continued) -

8a - (Cont.)	.0005061	.0004579	.0009158				Stability Category B, Fall (Cont.)
	.0010362	.0013736	.0009158				
			.0004579				
	.0005061	.0004579					
	.0000723	.0013736	.0009158				
	.0000482	.0009158					
	.0000723	.0013736					
	.0000000						
	.0005061	.0004579					
	.0004338	.0018315	.0018315				Stability Category C, Fall
			.0018315				
	.0001084	.0004579	.0018315				
			.0004579				
	.0012411	.0004579	.0009158				
	.0002169	.0009158	.0004579				
	.0007591	.0032051	.0027473				
	.0004338	.0018315	.0022894				
	.0005422	.0022894	.0041209				
			.0027473				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE SHEET 20 OF 26

CARD GROUP NUMBER

DATA CARD COLUMN

- FREQ (Continued) -

CARD GROUP NUMBER	1–10	11–20	21–30	31–40	41–50	51–60	
8a - (Cont.)			.0050366				Stability Category C, Fall (Cont.)
	.0001084	.0004579	.0068681				
	.0014339	.0036630	.0100733				
	.0001084	.0004579	.0050366				
	.0001084	.0004579	.0018315				
			.0018315				
	.0017156	.0151099	.0434982	.0119048			Stability Category D, Fall
	.0010962	.0077839	.0050366				
	.0006764	.0100733	.0082418	.0004579			
	.0000570	.0027473	.0036630	.0009158			
	.0005624	.0045788	.0027473				
	.0005149	.0022894	.0018315	.0004579			
	.0005909	.0059524	.0073260	.0004579			
	.0001045	.0050366	.0059524	.0009158			
	.0015256	.0059524	.0169414	.0018315			
	.0000855	.0041209	.0105311	.0100733	.0004579		
	.0001615	.0077839	.0256410	.0169414	.0013736	.0004579	
	.0000665	.0032051	.0302198	.0274725	.0050366	.0004579	
	.0020120	.0068681	.0425824	.0521978	.0077839	.0004579	

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM	LONGZ	**NAME**	
		DATE	**SHEET** 21 **OF** 26

CARD GROUP NUMBER — **DATA CARD COLUMN** 1–80

- FREQ (Continued) -

CARD GROUP NUMBER	1–10	11–20	21–30	31–40	41–50	51–60	
8a- (Cont.)	.0001520	.0007260	.0242674	.0283883	.0032051		Stability Category D, Fall (Cont.)
	.0015446	.0068681	.0196886	.0178571	.0022894		
	.0005814	.0054945	.0206044	.0128205	.0004579		
	.0023013	.0077839	.0082418				Stability Categories E & F, Fall
	.0005530	.0041209	.0009158				
	.0045906	.0050366	.0004579				
	.0037641	.0032051					
	.0052329	.0045788	.0004579				
	.0051437	.0050366					
	.0049593	.0068682	.0013736				
	.0059702	.0054945	.0018315				
	.0101149	.0160256	.0064103				
	.0036868	.0119048	.0036630				
	.0046917	.0105311	.0059524				
	.0087353	.0160256	.0109890				
	.0191356	.0352564	.0164835				
	.0036808	.0091575	.0032051				
	.0066243	.0141942	.0032051				
	.0019326	.0036630	.0045788				

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 22 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN 1–80

- TA (omit if ISW(1) = 1) -

9-	273.2	273.2	273.2	271.2	269.7	
	287.0	287.0	287.0	283.7	280.3	
	298.3	298.3	298.3	294.4	290.7	
	289.5	289.5	289.5	286.3	282.4	

- HM (omit if ISW(1) = 1) -

10-	500	650				
	500	650	710			
	500	650	710	710	710	710
	320	470	670	710	710	710
	140	290	630			
	1530	1530				
	1530	1530	1530			
	1530	1530	1530	1530	1530	1530
	825	920	1030	1415	1530	1530
	120	310	530			
	1730	1730				
	1730	1730	1730			
	1730	1730	1730	1730	1730	1730

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 23 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- HM (Continued) -

10- (Cont.)	960	1025	1235	1295	1295	1295
	190	320	740			
	1230	1230				
	1230	1230	1230			
	1230	1230	1230	1230	1230	1230
	685	740	970	1190	1230	1230
	140	250	710			

- DPDZ (omit if ISW(I) = I) -

11-	0					
	0					
	0					
	.015	.010	.005	.003	.003	.003
	.030	.020	.015			

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 24 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

12-

- (omit if ISW(1) = 1) -

ROTATE	TK	HA	UTMX	UTMY	G	ZR	GAMMA1	GAMMA2	DECAY
-blank card, default values-									

13-

- SIGEPU (omit if ISW(1) = 1) -

.1745	.1745	.1745	.1745	.1745	.1745
.1745	.1745	.1745	.1745	.1745	.1745
.1080	.1080	.1080	.1080	.1080	.1080
.0735	.0735	.0735	.0735	.0735	.0735
.0465	.0465	.0465	.0465	.0465	.0465

14-

- SIGEPL (omit if ISW(1) = 1 or if ISW(16) = 0) -

-omit-					

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 25 OF 26

CARD GROUP NUMBER

DATA CARD COLUMN

- UBAR (omit if ISW(1)=1) -

15- -- blank card, default values --

- P (omit if ISW(1)=1) -

Card group	1–10	11–20	21–30	31–40	41–50	51–60
16-	.10	.10				
	.10	.10	.10			
	.20	.15	.10	.10	.10	
	.25	.20	.15	.10	.10	.10
	.30	.25	.20			

- THETA (omit if ISW(1)=1) -

17- -- blank card, default values --

-- blank card, default values --

- SFMT (omit if NSOURC=0 or ISW(12)=0) -

18- -- omit --

FIGURE D-1. (Continued)

INPUT DATA CODING FORM

PROJECT EXAMPLE LONG TERM PROBLEM

LONGZ

NAME

DATE

SHEET 26 **OF** 26

CARD GROUP NUMBER

DATA CARD COLUMN

- (omit if NSOURC = O) -

CARD GROUP NUMBER	NUMSQI	TYPEI	DISP	QI(1)	QI(2)	QI(3)	QI(4)	DXI	DYI	HI	HSI	TSI OR SII	VOLI OR S2I	RDSI	NVSI
*18a-	1			3.78	3.78	3.78	3.78	-350	0	60		370	267.5	1.85	
	2			.60	.60	.60	.60	-100	250	30		340	106.0	1.30	
	3			.20	.20	.20	.60	200	350	25		590	10.8	.54	
	4	1		.73	.73	.73	.73	-200	0	15		200	200		
	5	1		.73	.73	.73	.73	0	0	15		200	200		
	6	1		.73	.73	.73	.73	200	0	15		200	200		

* This form shows the default format for Card Group 18a.

FIGURE D-1. (Continued)

b. Card Group 2. Card Group 2 specifies the number of categories of meteorological data and the number of sources and receptors in the grid system. The parameter NSOURC is set equal to "6" for the six sources used to model the hypothetical aluminum plant. The parameter NGROUP equals "5" because we wish to print the output for five different source groupings. The parameters NXPNTS and NYPNTS are both set equal to "19" for the 19-X by 19-Y receptor grid system. The parameter NXWYPT is set to "28" and specifies 28 discrete points that are used in this example. The parameter NSEASN is set equal to "4" as we are using seasonal input meteorological data. Also, the number of Pasquill stability categories, NSTBLE, is set equal to "5" (E and F combined). The remaining parameters on this card will assume their respective default values (NSORX="0", NSPEED="6", NSCTOR="16", NSTOP="999999", LUNT="MICROGRAMS PER CUBIC METER" and LKNT="GRAMS/SEC").

c. Card Group 3. Card Group 3 selects the program control options desired. This card shows: ISW(1) and ISW(2) both blank (zero) because tape input/output is not being used, ISW(3) and ISW(4) equal to "1" for seasonal and annual concentration tables, ISW(5) equal to "1" to print the input control and meteorological data and ISW(6) equal to "1" for a print output of the sources. The remaining options on this card are left blank, as well as the tape input/output parameters.

d. Card Group 4 & 5. Card Groups 4 and 5 define the source combinations for which concentration output is to be produced. The parameter NGROUP on Card Group 2 specifies five source combinations. Card Group 4 (NSOGRP) gives the number of source ID-numbers the program is to use to define each source combination. The first three output combinations have one defining source, the fourth uses two defining sources and the fifth uses only one. Card Group 5 shows the actual source ID-numbers the program is to use in each source combination. The program is to output seasonal and annual concentrations for Source 1, Source 2, Source 3, Sources 4 through 6 combined and all sources (1-6) combined.

e. Card Groups 6, 6a, 7 and 7a. Card Groups 6, 6a, 7 and 7a define the locations of the receptors of the regular (non-discrete) grid system and the discrete points. Both the regular grid system (Card Groups 6 and 7) and the discrete receptors (Card Groups 6a and 7a) are in Cartesian coordinates. Note that only those cards punched from these groups are included in the input deck, not the blank images on the coding forms.

f. Card Groups 7b and 7c. Card Groups 7b and 7c are not shown in Figure D-1 because we are assuming flat terrain (ISW(8) equal to "0"). Thus, the terrain elevation cards are omitted from the input deck.

g. Card Group 8. Card Group 8 is used to specify an optional format the program uses to read Card Group 8a. Because ISW(11) is left blank (zero), this card group is not used by the program and is omitted from the input deck. The program will use the default Fortran format of (6F10.0) to read the data shown in Card Group 8a. This default format requires the user to punch the frequency of occurrence data in Card Group 8a using 10 columns per value including the decimal point (period). Only NSPEED values are read per data card in Card Group 8a.

h. Card Group 8a. Card Group 8a gives the joint frequency of occurrence of wind speed and direction by stability category and season. As the example run is using seasonal data, all four seasons (winter, spring, summer, fall) are punched. Within each season, there are five stability categories (A through E) and within each stability category there are sixteen cards, one for each wind direction category clockwise from north to north-northwest. Each data card contains the frequency of occurrence for the six wind-speed categories. Values that are zero have been left blank because the LONGZ program interprets blanks as zeros.

i. Card Group 9. Card Group 9 gives the seasonal ambient air temperatures in degrees Kelvin for stability categories A through E (E and F have been combined into E).

j. Card Group 10. Card Group 10 gives the seasonal median mixing layer depths in meters. The mixing layer depths are punched, six values per card, for wind-speed categories 1 through 6, and there are five cards for stability categories A through E and four groups of these cards, one for each season. Some values have been left blank in this card group in Figure D-1 because the joint frequency of occurrence of these wind-speed and stability categories is zero (and no calculations will take place). Note also that the decimal point is not punched. The decimal point can be eliminated in real variables only when the values are whole numbers and right justified in the respective punch columns. The values of Hm given here are taken from Table 2-16 in Section 2.6.2.

k. Card Group 11. Card Group 11 gives the vertical potential temperature gradients for each wind speed category (across the cards) and each stability category. Values not punched (blank) are assumed zero or are not used because the joint frequency of occurrence of the speed and stability category is zero. These values are taken from Table 2-18 in Section 2.6.2.

l. Card Group 12. Card Group 12 is left blank and all parameters assume their respective default values (ROTATE="0", TK="1.0×10^6", HA="0", UTMX="0", UTMY="0", G="9.8", ZR="6.096", GAMMA1=".6", GAMMA2=".66" and DECAY="0").

m. Card Group 13 and 14. Card Groups 13 and 14 give the vertical turbulent intensities for the stack and building sources. These values are taken from Table 2-15 in Section 2.6.2. Note that, because ISW(16) is "0", Card Group 14 is omitted from the input deck and all turbulent intensities are taken from Card Group 13.

n. Card Group 15. Card Group 15 gives the median wind speed for each speed category and is left blank so the program will assume the default wind speed category values.

o. Card Group 16. Card Group 16 gives the wind-profile power law exponents by wind speed and stability category. These values are taken from Table 2-19 in Section 2.6.2.

p. Card Group 17. Card Group 17 consists of two data cards and gives the median value of each wind direction category. As we wish to use the program default values, these cards are left blank.

q. Card Group 18. Card Group 18 gives the format of the source data in Card Group 18a and is omitted from the input deck because ISW(12) equals "0" and we are using the default format for the source data.

r. Card Groups 18a, 18b and 18c. Card Groups 18a through 18c provide all of the source information. Figure D-1 shows only Card Group 18a, but Figure F-1 (example coding form) shows each of these card groups on a separate page. The coding forms are ordered in the manner shown to facilitate key punching. However, this is not the correct order for input to the program. These data cards must be reordered, when used, prior to input to the program. Card Group 18a in Figure D-1 shows Sources 1 through 6. The parameter DISP is blank (="0") for each source as this run is the initial entry of these sources and there is no input tape. The parameter TYPE1 identifies the type of source ("0"=stack, "1"=building). The emissions from each source vary with season only and are shown as Q1(1) through Q1(4). Card Group 18a also gives the location, height, elevation, exit temperature, and the volumetric emission rate or source dimensions (depending on TYPE1) and the inner radius of the stack (TYPE1="0" only). Because the emission rates vary only with season (DISP≠"3"), Card Group 18b is omitted from the input deck. Also, Card Group 18c is omitted from the input deck because the parameter NVS1 for each source is left blank. The parameter NVS1 is not punched because the particulate emissions are assumed to have negligible gravitational settling velocities and are treated as gaseous emissions.

D.2.2 Run Time, Required Data Storage and Page Output Estimates

The run time, data storage and page output estimate calculated for the example concentration run are given in the following paragraphs.

a. Run Time. The run time estimate is calculated using Equation (4-2) in Section 4.2.5 and is approximated by

$$\text{Time (seconds)} \cong \Big\{ \big[N_s \cdot (\text{NXPNTS} \cdot \text{NYPNTS} + \text{NXWYPT}) \cdot \text{NSEASN} \cdot \text{NSTBLE} \cdot \text{NSPEED} \big] \cdot 1.5 \times 10^{-3} + \big[(I + J + K) \cdot (\text{NXPNTS} \cdot \text{NYPNTS} + \text{NXWYPT}) \cdot \text{NSEASN} \big] \cdot 2.2 \times 10^{-3} \Big\} \qquad \text{(D-1)}$$

Substituting values from Figure D-1,

$$\begin{aligned} \text{Time (seconds)} &\cong \Big\{ \big[6 \cdot (19 \cdot 19 + 28) \cdot 4 \cdot 5 \cdot 6 \big]\ 1.5 \times 10^{-3} + \big[(0 + 0 + 12) \cdot (19 \cdot 19 + 28) \cdot 4 \big] \cdot 2.2 \times 10^{-3} \Big\} \\ &\cong 420.12 + 41.08 \\ &\cong 461.2 \end{aligned} \qquad \text{(D-2)}$$

The actual run time was 130 seconds. The values of f (1.5×10^{-3}) and g (2.2×10^{-3}) are taken from worst case long-term runs and may often over predict the actual run time.

b. Required Data Storage. The required data storage must be calculated to determine whether or not the desired run will fit in the LONGZ program. The amount of data storage required by a particular run is determined by Equation (4-1) in Section 4.1.2.

Taking values from Figure D-1 and substituting in Equation (4-1) we calculate

$$\begin{aligned} 12000 &\geq \left[19 + 19 + 2 \cdot 28\right] + 6 \cdot (19 \cdot 19 + 28) \\ &\geq 2428 \end{aligned} \tag{D-3}$$

c. Page Output. The page output estimate is calculated using equation (4-3) in Section 4.2.5 giving the output pages as

$$\text{Pages} \simeq A + B + C \tag{D-4}$$

The value of A from Equation (4-4) is

$$\begin{aligned} A^* &= 15 \cdot 1 + \left[\frac{6}{44}\right] \cdot 1 + \left[\frac{0}{44}\right] \cdot 0 + \left[\frac{6+0}{44}\right] \cdot 0 \\ &\quad + 0 \cdot \left(\left[\frac{19}{9}\right] \cdot \left[\frac{19}{38}\right] + \left[\frac{28}{129}\right]\right) \\ &= 16 \end{aligned} \tag{D-5}$$

The value of B, obtained from Equation (4-5), is given by

$$B \simeq 4 \cdot 5 \cdot \left[\frac{19}{9}\right] \cdot \left[\frac{19}{38}\right] + \left[\frac{28}{129}\right] \tag{D-6}$$

---

*The [ ] symbols indicate to round up to the next larger integer if there is any fractional part.

(Equation (D-6) continued.)

$$\begin{aligned} &\simeq 20\cdot(3\cdot 1 + 1) \\ &\simeq 140 \end{aligned} \tag{D-6}$$

The variable I in Equation (4-5) is set to "5" because we are printing both seasonal and annual tables. The variable N_c is set to "5" because NGROUP is input as "5". The variables N_x, N_y and N_{xy} have been set to "19", "19" and "28", respectively, defining the total number of receptor points. The total estimated output pages is then given by

$$\begin{aligned} \text{Pages} &\simeq 16 + 140 + 5 \\ &\simeq 161 \end{aligned} \tag{D-7}$$

The actual number of pages output was 87 produced by the example concentration run.

D.2.3 Example Print Output.

Figure D-2 illustrates the printed concentration output for the example hypothetical aluminum plant. The listing begins by printing the input data under the heading "PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS". This part of the output listing includes all punched data and default values, except source data. Next, the source data are listed under the heading "INPUT SOURCE DATA". The remainder of the output listing in Figure D-2 shows the annual ground-level particulate concentrations due to selected sources, but does not show the complete output listing. The page number of each table in the output listing is shown in the upper right hand corner. For example, pages 28 and 29 (upper right hand corner) show the complete annual output for Source 1. The heading given is "ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1". The particulate concentrations calculated for the receptor grid system follow the page heading on page 28 and end at the middle of page 29. The concentrations at the discrete receptors are then printed. Other concetration tables illustrated are from pages 70 and 71 of the output listing. These pages show the combined annual particulate concentrations from Sources 4 through 6. The last table shown is from pages 84 and 85 of the output listing and shows the annual particulate concentrations from all (1 through 6) sources. Selected seasonal tables from this example run are shown in Section 4.2.4 of the main body of the text.

```
     EXAMPLE LONG TERM PROBLEM                                                                                   DATE 061782, PAGE    1

                                                              TABLE    1

                                        *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

          NUMBER OF SOURCE INPUT CARDS                                 (NSOURC) =      6
          NUMBER OF X GRID COORDINATES                                 (NXPNTS) =     19
          NUMBER OF Y GRID COORDINATES                                 (NYPNTS) =     19
          NUMBER OF SEASONS (IF 1 ANNUAL ASSUMED)                      (NSEASN) =      4
          NUMBER OF WIND SPEED CATEGORIES                              (NSPEED) =      6
          NUMBER OF STABILITY CATEGORIES                               (NSTBLE) =      5
          NUMBER OF WIND DIRECTION (SECTOR) CATEGORIES                 (NSCTOR) =     16
          NUMBER OF CONCENTRATION REPORTS (SOURCE COMBINATIONS)(NGROUP) =      5
          LAST TAPE INPUT SOURCE                                       (NSTOP ) = 999999
          NUMBER OF DISCRETE X,Y POINTS                                (NXWYPT) =    28
          TOTAL NUMBER OF SOURCES IN INVENTORY                                  =     6
          IS TAPE INPUT USED (0 IS NO, NOT 0 IS YES)                   (ISW(1)) = 0
          IS TAPE OUTPUT USED                                          (ISW(2)) = 0
          IS OUTPUT TAPE SOURCE INVENTORY LISTING PRODUCED             (ISW(2)) = 0
          ARE CONCENTRATION REPORTS ON A SEASONAL BASIS                (ISW(3)) = 1
          ARE CONCENTRATION REPORTS ON AN ANNUAL BASIS                 (ISW(4)) = 1
          IS AN INPUT CARD SOURCE INVENTORY LISTING PRODUCED           (ISW(6)) = 1
          IS AN INPUT TAPE SOURCE INVENTORY LISTING PRODUCED           (ISW(7)) = 0
          ARE TERRAIN HEIGHTS INPUT                                    (ISW(8)) = 0
          IS UBAR TERRAIN FOLLOWING                                    (ISW(9)) = 0
          IS THE FORMAT FOR FREE (CARD GROUP 8A) READ                  (ISW(11))= 0
          IS THE FORMAT FOR SOURCE CARDS (CARD GROUP 19A) READ (ISW(12))= 0
          GRID SYSTEM IS IN CARTESIAN (=0) OR POLAR (=1) COORDS(ISW(13))= 0
          DISCRETE POINTS ARE CARTESIAN (=0) OR POLAR (=1)             (ISW(14))= 0
          SOURCE COORDINATES ARE CARTESIAN (=0) OR POLAR (=1)          (ISW(15))= 0
          SIGEPU OPTION FOR STACK, BUILDING, AREA SOURCE               (ISW(16))= 0
          RURAL/URBAN MODE (RURAL=0), (URBAN=1)                        (ISW(17))= 0
          CONCENTRATION UNITS CONVERSION FACTOR,                                 = .10000000+007
          ACCELERATION OF GRAVITY (G METERS/SEC**2) =    9.8000
          HEIGHT OF MEASUREMENT OF WIND SPEED (ZR METERS) =  6.096
          ENTRAINMENT PARAMETER FOR AN UNSTABLE ATMOSPHERE (GAMMA1) =  .500
          ENTRAINMENT PARAMETER FOR A STABLE ATMOSPHERE (GAMMA2) =  .660
          ANGULAR DISPLACEMENT OF GRID SYSTEM FROM TRUE NORTH (ROTATE DEGREES) =      .000
          DECAY COEFFICIENT        (DECAY) =  .00000000
          ELEVATION OF WEATHER STATION (HA METERS =        .00
          X ORIGIN OF POLAR COORDINATES (UTMX METERS) =          .00
          Y ORIGIN OF POLAR COORDINATES (UTMY METERS) =          .00
                    *-* COORDINATE SYSTEM X AXIS (METERS) *-*

 -.30000000+004, -.20000000+004, -.15000000+004, -.12000000+004, -.10000000+004, -.80000000+003, -.60000000+003, -.40000000+003,
 -.20000000+003,  .00000000     ,  .20000000+003,  .40000000+003,  .60000000+003,  .80000000+003,  .10000000+004,  .12000000+004,
  .15000000+004,  .20000000+004,  .30000000+004,
                    *-* COORDINATE SYSTEM Y AXIS (METERS )*-*

 -.30000000+004, -.20000000+004, -.15000000+004, -.12000000+004, -.10000000+004, -.80000000+003, -.60000000+003, -.40000000+003,
 -.20000000+003,  .00000000     ,  .20000000+003,  .40000000+003,  .60000000+003,  .80000000+003,  .10000000+004,  .12000000+004,
  .15000000+004,  .20000000+004,  .30000000+004,
```

FIGURE D-2. Example print output for the long-term (LONGZ) program example run.

```
                                                                                                          DATE 061782. PAGE    2
        EXAMPLE LONG TERM PROBLEM
                                                      TABLE    1 (CONT)

                                    *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                           *-* COORDINATES OF DISCRETE POINTS (METERS,METERS )*-*
                                                                                                                      0.      700.0),
 (X,Y) = (   -800.0,     700.0), (   -600.0,     700.0), (   -400.0,     700.0), (   -200.0,     700.0), (       800.0,     500.0),
 (X,Y) = (    200.0,     700.0), (    400.0,     700.0), (    600.0,     700.0), (    900.0,     700.0), (       800.0,    -500.0),
 (X,Y) = (    800.0,     300.0), (    800.0,     100.0), (    800.0,    -100.0), (    900.0,    -300.0), (      -200.0,    -500.0),
 (X,Y) = (    600.0,    -500.0), (    400.0,    -500.0), (    200.0,    -500.0), (       0.,    -500.0), (      -800.0,    -100.0),
 (X,Y) = (   -400.0,    -500.0), (   -600.0,    -500.0), (   -800.0,    -500.0), (   -900.0,    -300.0), (
 (X,Y) = (   -800.0,     100.0), (   -800.0,     300.0), (   -800.0,     500.0), (
                               *-* AMBIENT AIR TEMPERATURE (TA DEGREES KELVIN) *-*

                 STABILITY  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY
                 CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
       SEASON  1   273.2000   273.2000   273.2000   271.2000   269.7000
       SEASON  2   287.0000   287.0000   287.0000   283.7000   280.3000
       SEASON  3   290.3000   290.3000   290.3000   294.4000   290.7000
       SEASON  4   289.5000   289.5000   289.5000   296.3000   282.4000
                                 *-* MIXING LAYER DEPTH (HM METERS) *-*

                                                SEASON 1
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 STABILITY CATEGORY 1  .500000+003 .650000+003 .650000+003 .650000+003 .650000+003 .650000+003
 STABILITY CATEGORY 2  .500000+003 .650000+003 .710000+003 .710000+003 .710000+003 .710000+003
 STABILITY CATEGORY 3  .500000+003 .650000+003 .710000+003 .710000+003 .710000+003 .710000+003
 STABILITY CATEGORY 4  .320000+003 .470000+003 .670000+003 .710000+003 .710000+003 .710000+003
 STABILITY CATEGORY 5  .140000+003 .290000+003 .630000+003 .630000+003 .630000+003 .630000+003
                                                SEASON 2
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 STABILITY CATEGORY 1  .153000+004 .153000+004 .153000+004 .153000+004 .153000+004 .153000+004
 STABILITY CATEGORY 2  .153000+004 .153000+004 .153000+004 .153000+004 .153000+004 .153000+004
 STABILITY CATEGORY 3  .153000+004 .153000+004 .153000+004 .153000+004 .153000+004 .153000+004
 STABILITY CATEGORY 4  .825000+003 .920000+003 .103000+004 .141500+004 .153000+004 .153000+004
 STABILITY CATEGORY 5  .120000+003 .310000+003 .530000+003 .530000+003 .530000+003 .530000+003
                                                SEASON 3
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 STABILITY CATEGORY 1  .173000+004 .173000+004 .173000+004 .173000+004 .173000+004 .173000+004
 STABILITY CATEGORY 2  .173000+004 .173000+004 .173000+004 .173000+004 .173000+004 .173000+004
 STABILITY CATEGORY 3  .173000+004 .173000+004 .173000+004 .173000+004 .173000+004 .173000+004
 STABILITY CATEGORY 4  .960000+003 .132500+004 .123500+004 .129500+004 .129500+004 .129500+004
 STABILITY CATEGORY 5  .190000+003 .320000+003 .740000+003 .740000+003 .740000+003 .740000+003
                                                SEASON 4
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 STABILITY CATEGORY 1  .123000+004 .123000+004 .123000+004 .123000+004 .123000+004 .123000+004
 STABILITY CATEGORY 2  .123000+004 .123000+004 .123000+004 .123000+004 .123000+004 .123000+004
 STABILITY CATEGORY 3  .123000+004 .123000+004 .123000+004 .123000+004 .123000+004 .123000+004
```

Figure D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                    DATE 061782, PAGE    3

                                                  TABLE    1 (CONT)

                                    *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                                    *-* MIXING LAYER DEPTH (HM METERS) *-*

                                                      SEASON 4
                            WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                            CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
   STABILITY CATEGORY 4  .695000+003  .710000+003  .970000+003  .119000+004  .123000+004  .123000+004
   STABILITY CATEGORY 5  .140000+003  .250000+003  .710000+003  .710000+003  .710000+003  .710000+003
                       *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                     SEASON 1
                                                STABILITY CATEGORY 1
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
      DIRECTION        (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
    (PHI DEGREES)
           .000          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
         22.500          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
         45.000          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
         67.500          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
         90.000          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
        112.500          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
        135.000          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
        157.500          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        180.000          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
        202.500          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        225.000          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        247.500          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
        270.000          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        292.500          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        315.000          .00302860   .00000000   .00000000   .00000000   .00000000   .00000000
        337.500          .00302960   .00000000   .00000000   .00000000   .00000000   .00000000
                                                     SEASON 1
                                                STABILITY CATEGORY 2
                          WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
      DIRECTION        (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
    (PHI DEGREES)
           .000          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
         22.500          .00322890   .00045730   .00000000   .00000000   .00000000   .00000000
         45.000          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
         67.500          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
         90.000          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
        112.500          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
        135.000          .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
 EXAMPLE LONG TERM PROBLEM                                                                DATE 061782, PAGE    4
                                              TABLE    1 (CONT)

                           *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                 *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                         SEASON 1
                                  STABILITY CATEGORY 2
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION    (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
    157.500       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    180.000       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    202.500       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    225.000       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    247.500       .00068680   .00000000   .00000000   .00000000   .00000000   .00000000
    270.000       .00068680   .00000000   .00000000   .00000000   .00000000   .00000000
    292.500       .00022890   .00045790   .00000000   .00000000   .00000000   .00000000
    315.000       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    337.500       .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
                                         SEASON 1
                                  STABILITY CATEGORY 3
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION    (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
       .000       .00008720   .00045790   .00091580   .00000000   .00000000   .00000000
     22.500       .00000000   .00000000   .00045790   .00000000   .00000000   .00000000
     45.000       .00000000   .00000000   .00045790   .00000000   .00000000   .00000000
     67.500       .00109020   .00000000   .00045790   .00000000   .00000000   .00000000
     90.000       .00063230   .00045790   .00000000   .00000000   .00000000   .00000000
    112.500       .00008720   .00045790   .00000000   .00000000   .00000000   .00000000
    135.000       .00008720   .00045790   .00091580   .00000000   .00000000   .00000000
    157.500       .00109020   .00000000   .00045790   .00000000   .00000000   .00000000
    180.000       .00017440   .00091580   .00228940   .00000000   .00000000   .00000000
    202.500       .00000000   .00000000   .00091580   .00000000   .00000000   .00000000
    225.000       .00000000   .00000000   .00228940   .00000000   .00000000   .00000000
    247.500       .00008720   .00045790   .00503660   .00000000   .00000000   .00000000
    270.000       .00043610   .00228940   .00366300   .00000000   .00000000   .00000000
    292.500       .00017440   .00091580   .00228940   .00000000   .00000000   .00000000
    315.000       .00063230   .00045790   .00091580   .00000000   .00000000   .00000000
    337.500       .00000000   .00000000   .00137360   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
     EXAMPLE LONG TERM PROBLEM
                                                                                               DATE 061782, PAGE    5
                                                      TABLE    1 (CONT)

                                     *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                          *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                     SEASON 1
                                               STABILITY CATEGORY 4
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION       (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
       .000         .00178990   .00549449   .02426738   .00824179   .00091580   .00000000
     22.500         .00248360   .00091580   .00412090   .00000000   .00000000   .00000000
     45.000         .00308330   .00137360   .00274730   .00000000   .00000000   .00000000
     67.500         .00311100   .00183150   .00274730   .00000000   .00000000   .00000000
     90.000         .00141530   .00732599   .00641029   .00000000   .00000000   .00000000
    112.500         .00181760   .00595239   .00549449   .00000000   .00000000   .00000000
    135.000         .00323290   .01327939   .01455199   .00412090   .00000000   .00000000
    157.500         .00349950   .00824179   .02197798   .00183150   .00000000   .00000000
    180.000         .00314960   .01190479   .03296697   .01144639   .00183150   .00000000
    202.500         .00373540   .00412090   .02014640   .01282049   .00091580   .00000000
    225.000         .00373540   .00412090   .03113547   .03754577   .00686809   .00045790
    247.500         .00327750   .00457880   .03205127   .04532966   .00824179   .00000000
    270.000         .00370760   .00366300   .04349816   .07417573   .01419409   .00320510
    292.500         .00392960   .00732599   .01877298   .03525637   .01785709   .00091580
    315.000         .00349950   .00824179   .02335158   .02335158   .00961539   .00137360
    337.500         .00305330   .00503660   .02747247   .02014648   .00183150   .00000000
                                                     SEASON 1
                                               STABILITY CATEGORY 5
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION       (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
       .000         .00340060   .00366310   .00412090   .00000000   .00000000   .00000000
     22.500         .00365820   .00091580   .00045790   .00000000   .00000000   .00000000
     45.000         .00340060   .00457880   .00000000   .00000000   .00000000   .00000000
     67.500         .00359140   .00045790   .00045790   .00000000   .00000000   .00000000
     90.000         .00283310   .01327939   .00000000   .00000000   .00000000   .00000000
    112.500         .00197460   .00549459   .00000000   .00000000   .00000000   .00000000
    135.000         .00527510   .01739920   .00045790   .00000000   .00000000   .00000000
    157.500         .00422580   .01648348   .00274730   .00000000   .00000000   .00000000
    180.000         .00455010   .01877298   .00595239   .00000000   .00000000   .00000000
    202.500         .00139270   .00732599   .00549449   .00000000   .00000000   .00000000
    225.000         .00366770   .00641029   .00915749   .00000000   .00000000   .00000000
    247.500         .00205090   .00961539   .00696809   .00000000   .00000000   .00000000
    270.000         .00171700   .00549459   .00732599   .00000000   .00000000   .00000000
    292.500         .00379170   .00320510   .00228940   .00000000   .00000000   .00000000
    315.000         .00333390   .00320520   .00274730   .00000000   .00000000   .00000000
    337.500         .00306680   .00137370   .00274730   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                         DATE 061782, PAGE    6

                                                  TABLE    1 (CONT)

                                  *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                        *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                 SEASON 2
                                            STABILITY CATEGORY 1
                  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                  CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION      (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
       .000        .00010060   .00045290   .00000000   .00000000   .00000000   .00000000
     22.500        .00055350   .00000000   .00000000   .00000000   .00000000   .00000000
     45.000        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     67.500        .00020130   .00090580   .00000000   .00000000   .00000000   .00000000
     90.000        .00020130   .00090580   .00000000   .00000000   .00000000   .00000000
    112.500        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    135.000        .00010060   .00045290   .00000000   .00000000   .00000000   .00000000
    157.500        .00010060   .00045290   .00000000   .00000000   .00000000   .00000000
    180.000        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    202.500        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    225.000        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    247.500        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    270.000        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    292.500        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    315.000        .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
    337.500        .00055350   .00000000   .00000000   .00000000   .00000000   .00000000
                                                 SEASON 2
                                            STABILITY CATEGORY 2
                  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                  CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION      (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
       .000        .00053380   .00181160   .00317030   .00000000   .00000000   .00000000
     22.500        .00003230   .00090580   .00090580   .00000000   .00000000   .00000000
     45.000        .00004850   .00135870   .00000000   .00000000   .00000000   .00000000
     67.500        .00004850   .00135870   .00090580   .00000000   .00000000   .00000000
     90.000        .00003230   .00090580   .00000000   .00000000   .00000000   .00000000
    112.500        .00050140   .00090580   .00045290   .00000000   .00000000   .00000000
    135.000        .00148810   .00226450   .00000000   .00000000   .00000000   .00000000
    157.500        .00143960   .00090580   .00090580   .00000000   .00000000   .00000000
    180.000        .00009700   .00271740   .00135870   .00000000   .00000000   .00000000
    202.500        .00048520   .00045290   .00045290   .00000000   .00000000   .00000000
    225.000        .00001620   .00045290   .00045290   .00000000   .00000000   .00000000
    247.500        .00003230   .00090580   .00090580   .00000000   .00000000   .00000000
    270.000        .00008090   .00226450   .00090580   .00000000   .00000000   .00000000
    292.500        .00003230   .00090580   .00181160   .00000000   .00000000   .00000000
    315.000        .00006470   .00181160   .00045290   .00000000   .00000000   .00000000
    337.500        .00004850   .00135870   .00090580   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                      DATE 061782, PAGE    7

                                                 TABLE    1 (CONT)

                                  *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                         *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                  SEASON 2
                                            STABILITY CATEGORY 3
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 DIRECTION      (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
      .000        .00029640   .00271740   .00724640   .00000000   .00000000   .00000000
    22.500        .00000000   .00000000   .00181160   .00000000   .00000000   .00000000
    45.000        .00014920   .00135870   .00045290   .00000000   .00000000   .00000000
    67.500        .00060110   .00090580   .00045290   .00000000   .00000000   .00000000
    90.000        .00039530   .00362320   .00135870   .00000000   .00000000   .00000000
   112.500        .00115280   .00135870   .00362320   .00000000   .00000000   .00000000
   135.000        .00089760   .00362320   .00271740   .00045290   .00000000   .00000000
   157.500        .00009080   .00090580   .00317030   .00000000   .00000000   .00000000
   180.000        .00115280   .00135870   .00543480   .00000000   .00000000   .00000000
   202.500        .00055170   .00045290   .00226450   .00000000   .00045290   .00000000
   225.000        .00065050   .00135870   .00271740   .00045290   .00090580   .00000000
   247.500        .00004940   .00045290   .00815220   .00181160   .00000000   .00000000
   270.000        .00014820   .00135870   .00996379   .00045290   .00000000   .00000000
   292.500        .00014820   .00135870   .00724640   .00045290   .00000000   .00000000
   315.000        .00004940   .00045290   .00452900   .00181160   .00090580   .00000000
   337.500        .00000000   .00000000   .00452900   .00000000   .00000000   .00000000
                                                  SEASON 2
                                            STABILITY CATEGORY 4
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
 DIRECTION      (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
      .000        .00017030   .00498190   .02219199   .01947459   .00135870   .00000000
    22.500        .00004650   .00135870   .00679350   .00090580   .00000000   .00000000
    45.000        .00009290   .00271740   .00271740   .00000000   .00000000   .00000000
    67.500        .00006190   .00181160   .00588770   .00045290   .00000000   .00000000
    90.000        .00012390   .00362320   .01403999   .00045290   .00000000   .00000000
   112.500        .00007740   .00226450   .01096959   .00271740   .00000000   .00000000
   135.000        .00062320   .00452900   .01721009   .00271740   .00000000   .00000000
   157.500        .00057680   .00317030   .00996379   .00271740   .00045290   .00000000
   180.000        .00013940   .00407610   .01630429   .01268119   .00181160   .00000000
   202.500        .00048390   .00045290   .01358699   .01222829   .00181160   .00000000
   225.000        .00010840   .00317030   .03079708   .02264499   .00181160   .00000000
   247.500        .00012390   .00362320   .02355069   .03849638   .00498190   .00181160
   270.000        .00012390   .00362320   .02490939   .04347828   .01403989   .00407610
   292.500        .00062320   .00452900   .01947459   .02853258   .00860510   .00045290
   315.000        .00107610   .00407610   .01947459   .03759058   .00905800   .00181160
   337.500        .00007740   .00226450   .01721009   .01856879   .00317030   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                                DATE 061782, PAGE    8

                                                  TABLE    1 (CONT)

                                 *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                          *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                     SEASON 2
                                               STABILITY CATEGORY 5
                  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                  CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION     (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
         .000     .00081560   .00452900   .01539859   .00000000   .00000000   .00000000
       22.500     .00229080   .00226450   .00181160   .00000000   .00000000   .00000000
       45.000     .00377920   .00498190   .00000000   .00000000   .00000000   .00000000
       67.500     .00058260   .00498190   .00135870   .00000000   .00000000   .00000000
       90.000     .00539720   .01403989   .00045290   .00000000   .00000000   .00000000
      112.500     .00434860   .00769930   .00045290   .00000000   .00000000   .00000000
      135.000     .00570730   .00679350   .00000000   .00000000   .00000000   .00000000
      157.500     .00303450   .00905800   .00181160   .00000000   .00000000   .00000000
      180.000     .00720880   .01494569   .00679350   .00000000   .00000000   .00000000
      202.500     .00068590   .00588770   .00000000   .00000000   .00000000   .00000000
      225.000     .00274370   .00769930   .00000000   .00000000   .00000000   .00000000
      247.500     .00207090   .00860510   .00543480   .00000000   .00000000   .00000000
      270.000     .00748130   .01449279   .00543480   .00000000   .00000000   .00000000
      292.500     .00519050   .01313409   .00362320   .00000000   .00000000   .00000000
      315.000     .00573360   .00724640   .00679350   .00000000   .00000000   .00000000
      337.500     .00207090   .00407610   .00452900   .00000000   .00000000   .00000000
                                                     SEASON 3
                                               STABILITY CATEGORY 1
                  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                  CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION     (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
         .000     .00003940   .00090580   .00000000   .00000000   .00000000   .00000000
       22.500     .00051200   .00090580   .00000000   .00000000   .00000000   .00000000
       45.000     .00003940   .00090580   .00000000   .00000000   .00000000   .00000000
       67.500     .00001970   .00045290   .00000000   .00000000   .00000000   .00000000
       90.000     .00001970   .00045290   .00000000   .00000000   .00000000   .00000000
      112.500     .00047260   .00000000   .00000000   .00000000   .00000000   .00000000
      135.000     .00001970   .00045290   .00000000   .00000000   .00000000   .00000000
      157.500     .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      180.000     .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      202.500     .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      225.000     .00009850   .00226450   .00000000   .00000000   .00000000   .00000000
      247.500     .00001970   .00045290   .00000000   .00000000   .00000000   .00000000
      270.000     .00005910   .00135870   .00000000   .00000000   .00000000   .00000000
      292.500     .00001970   .00045290   .00000000   .00000000   .00000000   .00000000
      315.000     .00003940   .00090580   .00000000   .00000000   .00000000   .00000000
      337.500     .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                              DATE 061782, PAGE    9

                                                   TABLE    1 (CONT)

                                *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                         *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                  SEASON 3
                                            STABILITY CATEGORY 2
                   WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                   CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION    (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
  (PHI DEGREES)
        .000      .00157830   .00588769   .00407609   .00000000   .00000000   .00000000
      22.500      .00050790   .00135870   .00045290   .00000000   .00000000   .00000000
      45.000      .00050790   .00135870   .00045290   .00000000   .00000000   .00000000
      67.500      .00100190   .00226450   .00135870   .00000000   .00000000   .00000000
      90.000      .00009610   .00317029   .00090580   .00000000   .00000000   .00000000
     112.500      .00056270   .00317029   .00226450   .00000000   .00000000   .00000000
     135.000      .00104300   .00362319   .00090580   .00000000   .00000000   .00000000
     157.500      .00247030   .00452899   .00271739   .00000000   .00000000   .00000000
     180.000      .00344470   .00588769   .00317029   .00000000   .00000000   .00000000
     202.500      .00050780   .00135870   .00090580   .00000000   .00000000   .00000000
     225.000      .00005490   .00181160   .00135870   .00000000   .00000000   .00000000
     247.500      .00057640   .00362319   .00317029   .00000000   .00000000   .00000000
     270.000      .00057640   .00362319   .00181160   .00000000   .00000000   .00000000
     292.500      .00005490   .00181160   .00090580   .00000000   .00000000   .00000000
     315.000      .00008230   .00271739   .00317029   .00000000   .00000000   .00000000
     337.500      .00006960   .00226450   .00135870   .00000000   .00000000   .00000000
                                                  SEASON 3
                                            STABILITY CATEGORY 3
                   WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                   CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION    (  .7300MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
  (PHI DEGREES)
        .000      .00028920   .00317029   .00498189   .00000000   .00000000   .00000000
      22.500      .00074110   .00271739   .00317029   .00000000   .00000000   .00000000
      45.000      .00012350   .00135870   .00090580   .00000000   .00000000   .00000000
      67.500      .00008230   .00090580   .00317029   .00045290   .00000000   .00000000
      90.000      .00065880   .00181160   .00724638   .00181160   .00000000   .00000000
     112.500      .00065880   .00181160   .00090580   .00000000   .00000000   .00000000
     135.000      .00074110   .00271739   .00135870   .00000000   .00000000   .00000000
     157.500      .00189390   .00452899   .00135870   .00000000   .00000000   .00000000
     180.000      .00135870   .00407609   .00634059   .00000000   .00000000   .00000000
     202.500      .00000000   .00000000   .00407609   .00000000   .00000000   .00000000
     225.000      .00016470   .00181160   .00588769   .00090580   .00000000   .00000000
     247.500      .00041170   .00452899   .00769928   .00271739   .00000000   .00000000
     270.000      .00139990   .00452899   .01222827   .00362319   .00045290   .00045290
     292.500      .00020590   .00226450   .00724638   .00317029   .00045290   .00000000
     315.000      .00057640   .00090580   .00724638   .00045290   .00000000   .00000000
     337.500      .00065900   .00181160   .00498189   .00045290   .00000000   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                      DATE 061782, PAGE   10

                                              TABLE    1 (CONT)

                                *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                         *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                  SEASON 3
                                           STABILITY CATEGORY 4
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION      (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
        .000         .00122360   .00815218   .01932746   .00452899   .00000000   .00090580
      22.500         .00014300   .00407609   .00271739   .00000000   .00000000   .00000000
      45.000         .00020660   .00588769   .00226450   .00000000   .00000000   .00000000
      67.500         .00027020   .00769928   .00679349   .00000000   .00000000   .00000000
      90.000         .00153350   .00362319   .00634059   .00090580   .00000000   .00000000
     112.500         .00054820   .00226450   .00181160   .00045290   .00000000   .00000000
     135.000         .00117590   .00679349   .00226450   .00000000   .00000000   .00000000
     157.500         .00167650   .00769928   .00588769   .00000000   .00000000   .00000000
     180.000         .00320990   .01132248   .01222827   .00135870   .00000000   .00000000
     202.500         .00158120   .00498189   .01132248   .00317029   .00000000   .00000000
     225.000         .00044500   .01268117   .02536225   .01630427   .00000000   .00000000
     247.500         .00174010   .00951088   .03577892   .01358697   .00090580   .00000000
     270.000         .00141430   .01358697   .02219195   .01313407   .00135870   .00000000
     292.500         .00022250   .00634059   .00951088   .00679349   .00000000   .00000000
     315.000         .00072300   .00724638   .01756296   .00452899   .00045290   .00000000
     337.500         .00064360   .00498189   .01947466   .01313407   .00000000   .00000000
                                                  SEASON 3
                                           STABILITY CATEGORY 5
                    WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION      (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
        .000         .00757649   .01313407   .00815218   .00000000   .00000000   .00000000
      22.500         .00492049   .00634059   .00000000   .00000000   .00000000   .00000000
      45.000         .00169650   .00226450   .00000000   .00000000   .00000000   .00000000
      67.500         .00433709   .00498189   .00000000   .00000000   .00000000   .00000000
      90.000         .00971043   .01132248   .00135870   .00000000   .00000000   .00000000
     112.500         .00346969   .00271739   .00045290   .00000000   .00000000   .00000000
     135.000         .01440827   .01041668   .00045290   .00000000   .00000000   .00000000
     157.500         .01180607   .01041668   .00090580   .00000000   .00000000   .00000000
     180.000         .00967419   .01585147   .00135870   .00000000   .00000000   .00000000
     202.500         .00495809   .01041668   .00135870   .00000000   .00000000   .00000000
     225.000         .00429869   .01041668   .00317029   .00000000   .00000000   .00000000
     247.500         .01153739   .02038046   .00181160   .00000000   .00000000   .00000000
     270.000         .01560815   .01268117   .00407609   .00000000   .00000000   .00000000
     292.500         .01466927   .01403987   .00090580   .00000000   .00000000   .00000000
     315.000         .01007713   .01675726   .00362319   .00000000   .00000000   .00000000
     337.500         .00397629   .00996378   .00588769   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued

```
                                     TABLE    1 (CONT)

                     *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

            *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                         SEASON 4
                                   STABILITY CATEGORY 1
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION    (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
        .000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      22.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      45.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      67.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
      90.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     112.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     135.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     157.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     180.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     202.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     225.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     247.500      .00091580   .00000000   .00000000   .00000000   .00000000   .00000000
     270.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     292.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     315.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     337.500      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
                                         SEASON 4
                                   STABILITY CATEGORY 2
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
   DIRECTION    (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
 (PHI DEGREES)
        .000      .00002410   .00045790   .00045790   .00000000   .00000000   .00000000
      22.500      .00050610   .00045790   .00045790   .00000000   .00000000   .00000000
      45.000      .00053020   .00091580   .00091580   .00000000   .00000000   .00000000
      67.500      .00096390   .00000000   .00000000   .00000000   .00000000   .00000000
      90.000      .00007230   .00137360   .00000000   .00000000   .00000000   .00000000
     112.500      .00098800   .00045790   .00000000   .00000000   .00000000   .00000000
     135.000      .00057840   .00183150   .00045790   .00000000   .00000000   .00000000
     157.500      .00050610   .00045790   .00091580   .00000000   .00000000   .00000000
     180.000      .00103620   .00137360   .00091580   .00000000   .00000000   .00000000
     202.500      .00000000   .00000000   .00045790   .00000000   .00000000   .00000000
     225.000      .00050610   .00045790   .00000000   .00000000   .00000000   .00000000
     247.500      .00007230   .00137360   .00091580   .00000000   .00000000   .00000000
     270.000      .00004820   .00091580   .00000000   .00000000   .00000000   .00000000
     292.500      .00007230   .00137360   .00000000   .00000000   .00000000   .00000000
     315.000      .00000000   .00000000   .00000000   .00000000   .00000000   .00000000
     337.500      .00050610   .00045790   .00000000   .00000000   .00000000   .00000000
```

FIGURE D-2. (Continued)

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EXAMPLE LONG TERM PROBLEM                                                              DATE 061782, PAGE   12

                                            TABLE    1 (CONT)

                          *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                 *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                          SEASON 4
                                     STABILITY CATEGORY 3
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION     (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
      .000        .00043380   .00183150   .00183150   .00000000   .00000000   .00000000
    22.500        .00000000   .00000000   .00183150   .00000000   .00000000   .00000000
    45.000        .00010840   .00045790   .00183150   .00000000   .00000000   .00000000
    67.500        .00000000   .00000000   .00045790   .00000000   .00000000   .00000000
    90.000        .00124110   .00045790   .00091580   .00000000   .00000000   .00000000
   112.500        .00021690   .00091580   .00045790   .00000000   .00000000   .00000000
   135.000        .00075910   .00320510   .00274730   .00000000   .00000000   .00000000
   157.500        .00043380   .00183150   .00228940   .00000000   .00000000   .00000000
   180.000        .00054220   .00228940   .00412090   .00000000   .00000000   .00000000
   202.500        .00000000   .00000000   .00274730   .00000000   .00000000   .00000000
   225.000        .00000000   .00000000   .00503659   .00000000   .00000000   .00000000
   247.500        .00010840   .00045790   .00686809   .00000000   .00000000   .00000000
   270.000        .00143390   .00366300   .01007329   .00000000   .00000000   .00000000
   292.500        .00010840   .00045790   .00503659   .00000000   .00000000   .00000000
   315.000        .00010840   .00045790   .00183150   .00000000   .00000000   .00000000
   337.500        .00000000   .00000000   .00183150   .00000000   .00000000   .00000000
                                          SEASON 4
                                     STABILITY CATEGORY 4
                 WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                 CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
  DIRECTION     (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
(PHI DEGREES)
      .000        .00171560   .01510989   .04349816   .01190479   .00000000   .00000000
    22.500        .00109620   .00778389   .00503659   .00000000   .00000000   .00000000
    45.000        .00067640   .01007329   .00824179   .00045790   .00000000   .00000000
    67.500        .00005700   .00274730   .00366300   .00091580   .00000000   .00000000
    90.000        .00056240   .00457880   .00274730   .00000000   .00000000   .00000000
   112.500        .00051490   .00228940   .00183150   .00045790   .00000000   .00000000
   135.000        .00059090   .00595239   .00732599   .00045790   .00000000   .00000000
   157.500        .00010450   .00503659   .00595239   .00091580   .00000000   .00000000
   180.000        .00152560   .00595239   .01694138   .00183150   .00000000   .00000000
   202.500        .00008550   .00412090   .01053109   .01007329   .00045790   .00000000
   225.000        .00016150   .00778389   .02554097   .01694138   .00137360   .00045790
   247.500        .00006650   .00320510   .03021977   .02747247   .00503659   .00045790
   270.000        .00201200   .00686809   .04258236   .05219775   .00778389   .00045790
   292.500        .00015200   .00732599   .02426738   .02838827   .00320510   .00000000
   315.000        .00154460   .00686809   .01950858   .01785708   .00228940   .00000000
   337.500        .00058140   .00549449   .02060438   .01282049   .00045790   .00000000
```

FIGURE D-2. (Continued)

```
EXAMPLE LONG TERM PROBLEM                                                                          DATE 061782, PAGE   13
                                                        TABLE    1 (CONT)

                                     *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                            *-* FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*
                                                          SEASON 4
                                                     STABILITY CATEGORY 5
                         WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                         CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
      DIRECTION       (  .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MPS)(12.5000MPS)
   (PHI DEGREES)
          .000         .00230130    .00778389    .00824179    .00000000    .00000000    .00000000
        22.500         .00355300    .00412090    .00091580    .00000000    .00000000    .00000000
        45.000         .00459360    .00503659    .00045790    .00000000    .00000000    .00000000
        67.500         .00376410    .00320510    .00000000    .00000000    .00000000    .00000000
        90.000         .00523289    .00457980    .00045790    .00000000    .00000000    .00000000
       112.500         .00514369    .00503659    .00000000    .00000000    .00000000    .00000000
       135.000         .00495929    .00696319    .00137360    .00000000    .00000000    .00000000
       157.500         .00597019    .00549449    .00133150    .00000000    .00000000    .00000000
       180.000         .01011480    .01602558    .00641029    .00000000    .00000000    .00000000
       202.500         .00360680    .01190479    .00356300    .00000000    .00000000    .00000000
       225.000         .00469170    .01053109    .00595239    .00000000    .00000000    .00000000
       247.500         .00873529    .01602558    .01098899    .00000000    .00000000    .00000000
       270.000         .01913553    .03525636    .01648348    .00000000    .00000000    .00000000
       292.500         .00368080    .00915749    .00320510    .00000000    .00000000    .00000000
       315.000         .00562429    .01419419    .00320510    .00000000    .00000000    .00000000
       337.500         .00193260    .00356300    .00457880    .00000000    .00000000    .00000000
  *-* STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES (SIGEPU RADIANS) *-*

                       WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                       CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000
STABILITY CATEGORY 2 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000
STABILITY CATEGORY 3 .108000+000 .108000+000 .108000+000 .108000+000 .108000+000 .108000+000
STABILITY CATEGORY 4 .735000-001 .735000-001 .735000-001 .735000-001 .735000-001 .735000-001
STABILITY CATEGORY 5 .465000-001 .465000-001 .465000-001 .465000-001 .465000-001 .465000-001
    *-* STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES (SIGEPL RADIANS) *-*

                       WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                       CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000
STABILITY CATEGORY 2 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000 .174500+000
STABILITY CATEGORY 3 .108000+000 .108000+000 .108000+000 .108000+000 .108000+000 .108000+000
STABILITY CATEGORY 4 .735000-001 .735000-001 .735000-001 .735000-001 .735000-001 .735000-001
STABILITY CATEGORY 5 .465000-001 .465000-001 .465000-001 .465000-001 .465000-001 .465000-001
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FIGURE D-2. (Continued)

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          EXAMPLE LONG TERM PROBLEM
                                                                                                  DATE 061782, PAGE   14
                                                        TABLE    1 (CONT)

                                      *-* PROGRAM INPUT CONTROL AND METEOROLOGICAL PARAMETERS *-*

                               *-* VERTICAL POTENTIAL TEMPERATURE GRADIENT (DPDZ DEGREES KELVIN) *-*

                         WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                         CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .000000      .000000      .000000      .000000      .000000      .000000
STABILITY CATEGORY 2  .000000      .000000      .000000      .000000      .000000      .000000
STABILITY CATEGORY 3  .000000      .000000      .000000      .000000      .000000      .000000
STABILITY CATEGORY 4  .150000-001  .100000-001  .500000-002  .300000-002  .300000-002  .300000-002
STABILITY CATEGORY 5  .300000-001  .200000-001  .150000-001  .000000      .000000      .000000
                                      *-* WIND PROFILE POWER LAW EXPONENT (P) *-*

                         WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                         CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .100000+000  .100000+000  .100000+000  .100000+000  .100000+000  .100000+000
STABILITY CATEGORY 2  .100000+000  .100000+000  .100000+000  .100000+000  .100000+000  .100000+000
STABILITY CATEGORY 3  .200000+000  .150000+000  .100000+000  .100000+000  .100000+000  .100000+000
STABILITY CATEGORY 4  .250000+000  .200000+000  .150000+000  .100000+000  .100000+000  .100000+000
STABILITY CATEGORY 5  .300000+000  .250000+000  .200000+000  .150000+000  .100000+000  .100000+000
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FIGURE D-2. (Continued)

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          EXAMPLE LONG TERM PROBLEM

                                                                TABLE    2                                                DATE 051782, PAGE   15

                                                          *-* INPUT SOURCE DATA *-*

C T D SOURCE T      SOURCE EMISSION(GRAMS/SEC)                    X          Y        HEIGHT  ELEVATION   IF TYPE=0      IF TYPE=0      STACK
A A I NUMBER Y                                                                        ABOVE      AT      TEMP (DEG K)   VOL. EMISS.   INTERNAL
R P S        P SEASON 1   SEASON 2   SEASON 3   SEASON 4  COORDINATE COORDINATE  GROUND     BASE       IF TYPE=1OR2  RT. M**3/SEC    RADIUS
D E P        E OR ANNUAL                                   (METERS)   (METERS)  (METERS)  (METERS)  LENGTH SHORT    IF TYPE=1OR2   (MTR)
                                                                                                     SIDE (METERS) LENGTH LONG
                                                                                                                   SIDE (MTRS)
X   0      1 0    3.780      3.780      3.780      3.780    -350.00        .00     60.00       .00       370.000       267.500       1.85
X   0      2 0     .600       .600       .600       .600    -100.00     250.00     30.00       .00       340.000       106.000       1.30
X   0      3 0     .200       .200       .200       .200     200.00     350.00     25.00       .00       590.000        10.800        .54
X   0      4 1     .730       .730       .730       .730    -200.00        .00     15.00       .00       200.000       200.000        .00
X   0      5 1     .730       .730       .730       .730        .00        .00     15.00       .00       200.000       200.000        .00
X   0      6 1     .730       .730       .730       .730     200.00        .00     15.00       .00       200.000       200.000        .00
```

FIGURE D-2. (Continued)

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        EXAMPLE LONG TERM PROBLEM                                                                              DATE 061782, PAGE   29

                                                                 TABLE    7

              ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        1
                                                     - GRID SYSTEM X AXIS (METERS) -
                              (THE MAXIMUM CONCENTRATION IS      .3342176 AT X=   1200.0, Y=        .0)
                 -3000.000    -2000.000    -1500.000    -1200.000    -1000.000     -800.000     -600.000     -400.000     -200.000
Y AXIS (METERS )                                                  -  CONCENTRATION  -
          ----------------------------------------------------------------------------------------------------------------------

  3000.000      .0657812     .0737233     .0789163     .0904639     .0983871     .1063170     .1140818     .1214976     .1164424
  2000.000      .0657939     .1009417     .1035380     .1026990     .1153582     .1304855     .1461447     .1619269     .1528754
  1500.000      .0544416     .1052333     .1131752     .1076861     .1025810     .1168817     .1361314     .1571387     .1472273
  1200.000      .0444598     .0900249     .1138111     .1019665     .0921955     .0886200     .1067348     .1201784     .1200416
  1000.000      .0435112     .0767212     .0987529     .0932971     .0791244     .0659232     .0760146     .0944262     .0887995
   800.000      .0498832     .0612506     .0771307     .0772721     .0619206     .0451682     .0416062     .0530419     .0500894
   600.000      .0564691     .0552712     .0550004     .0504722     .0405052     .0243456     .0151506     .0180293     .0161209
   400.000      .0631352     .0646290     .0441134     .0292205     .0197301     .0089996     .0037619     .0027525     .0017865
   200.000      .0697597     .0742051     .0504273     .0263093     .0117042     .0034850     .0002277     .0000013     .0000166
      .000      .0761959     .0843790     .0582473     .0297778     .0118134     .0010075     .0000092     .0000000     .0000000
  -200.000      .0685632     .0723518     .0485787     .0249584     .0109949     .0030110     .0001864     .0000009     .0000283
  -400.000      .0607697     .0607697     .0402024     .0231492     .0127456     .0048973     .0019004     .0029933     .0022366
  -600.000      .0529790     .0495161     .0380228     .0267091     .0174252     .0115844     .0083620     .0200272     .0215265
  -800.000      .0453420     .0443433     .0395151     .0310625     .0264575     .0228208     .0328460     .0603510     .0657141
 -1000.000      .0379958     .0431965     .0406593     .0375947     .0361367     .0346694     .0660578     .1075721     .1120587
 -1200.000      .0338091     .0417705     .0418298     .0434039     .0439635     .0540903     .0974003     .1432972     .1465764
 -1500.000      .0315504     .0391120     .0447705     .0484955     .0507299     .0841396     .1253994     .1686825     .1691839
 -2000.000      .0276030     .0369793     .0447198     .0493357     .0735792     .1025840     .1331161     .1641737     .1627841
 -3000.000      .0221724     .0314964     .0411823     .0600469     .0733844     .0875996     .1017796     .1157723     .1144319


                                                     - GRID SYSTEM X AXIS (METERS) -
                              (THE MAXIMUM CONCENTRATION IS      .3342176 AT X=   1200.0, Y=        .0)
                      .000      200.000      400.000      600.000      800.000     1000.000     1200.000     1500.000     2000.000
Y AXIS (METERS )                                                  -  CONCENTRATION  -
          ----------------------------------------------------------------------------------------------------------------------

  3000.000      .1069709     .0972725     .0875448     .0779703     .0687079     .0664560     .0693217     .0720768     .0731815
  2000.000      .1354147     .1180513     .1010981     .1018861     .1114915     .1182070     .1222337     .1240045     .1187746
  1500.000      .1276836     .1039050     .1178735     .1380086     .1526735     .1618765     .1656450     .1630912     .1506029
  1200.000      .1038349     .1022907     .1359938     .1636042     .1833369     .1917565     .1937633     .1896071     .1719582
  1000.000      .0780662     .1039111     .1453596     .1804445     .2004265     .2102687     .2131777     .2081652     .1867561
   800.000      .0504797     .0968152     .1488153     .1885301     .2142675     .2282716     .2327064     .2270524     .2039455
   600.000      .0296397     .0769905     .1377907     .1904340     .2263899     .2457561     .2534836     .2498034     .2216136
   400.000      .0095662     .0494178     .1214323     .1909904     .2416743     .2696532     .2797169     .2735753     .2390123
   200.000      .0020611     .0318882     .1132931     .2033218     .2651951     .2969272     .3067185     .2971033     .2556606
      .000      .0010773     .0292085     .1230197     .2271452     .2948798     .3267957     .3342176     .3197260     .2710471
  -200.000      .0024859     .0272142     .1013526     .1855807     .2459202     .2785395     .2903952     .2842080     .2473362
  -400.000      .0131979     .0494943     .1037730     .1540275     .2025273     .2332932     .2476926     .2483371     .2226719
  -600.000      .0386556     .0820172     .1278737     .1646614     .1880304     .1987607     .2070426     .2132873     .1978455
  -800.000      .0736719     .1103873     .1482750     .1743903     .1892545     .1952096     .1941950     .1843081     .1735634
 -1000.000      .1105138     .1292890     .1560180     .1783572     .1884171     .1903857     .1874501     .1769500     .1525695
 -1200.000      .1374874     .1369074     .1559519     .1716981     .1829382     .1839524     .1796608     .1689052     .1460314
 -1500.000      .1555836     .1419866     .1450188     .1552723     .1624876     .1666003     .1663093     .1559194     .1356408
 -2000.000      .1500506     .1369667     .1234959     .1220501     .1269333     .1298098     .1311021     .1303337     .1179686
 -3000.000      .1076223     .1034349     .0930764     .0955490     .0781429     .0760634     .0779407     .0795573     .0795953
```

FIGURE D-2. (Continued)

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          EXAMPLE LONG TERM PROBLEM                                                                        DATE 061782, PAGE   29

                                                              TABLE    7 (CONT)

         ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        1
                                                        - GRID SYSTEM X AXIS (METERS) -
                           (THE MAXIMUM CONCENTRATION IS       .3342176 AT X=   1200.0, Y=        0)
                 3000.000)
 Y AXIS (METERS )                                                -  CONCENTRATION  -
                ------------------------------------------------------------------------------------------------------------------

      3000.000      .0678634
      2000.000      .0989479
      1500.000      .1178334
      1200.000      .1307095
      1000.000      .1398141
       800.000      .1488980
       600.000      .1578026
       400.000      .1663583
       200.000      .1743915
          .000      .1817346
      -200.000      .1707091
      -400.000      .1590775
      -600.000      .1470851
      -800.000      .1349767
     -1000.000      .1229736
     -1200.000      .1112738
     -1500.000      .0986629
     -2000.000      .0891814
     -3000.000      .0709458


                                                  *-* DISCRETE POINT RECEPTORS *-*
                          (THE MAXIMUM CONCENTRATION IS       .2790875 AT X=    800.0, Y=    100.0)
     X            Y      CONCENTRATION           X            Y       CONCENTRATION          X            Y       CONCENTRATION
                ------------------------------------------------------------------------------------------------------------------

   -800.0       700.0       .0344340        -600.0       700.0       .0265193        -400.0       700.0       .0335032
   -200.0       700.0       .0313295            .0       700.0       .0409941         200.0       700.0       .0885098
    400.0       700.0       .1451861         600.0       700.0       .1899025         800.0       700.0       .2204819
    800.0       500.0       .2322350         800.0       300.0       .2528633         800.0       100.0       .2790875
    800.0      -100.0       .2694395         800.0      -300.0       .2235444         800.0      -500.0       .1871303
    600.0      -500.0       .1592003         400.0      -500.0       .1153917         200.0      -500.0       .0652046
       .0      -500.0       .0237664        -200.0      -500.0       .0084338        -400.0      -500.0       .0088857
   -600.0      -500.0       .0043523        -800.0      -500.0       .0073524        -800.0      -300.0       .0037187
   -800.0      -100.0       .0022263        -800.0       100.0       .0024263        -800.0       300.0       .0051861
   -800.0       500.0       .0157196
```

FIGURE D-2. (Continued)

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     EXAMPLE LONG TERM PROBLEM                                                                                DATE 061782, PAGE   42

                                                          TABLE   12

            ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        2
                                                 - GRID SYSTEM X AXIS (METERS) -
                        (THE MAXIMUM CONCENTRATION IS      .2147621 AT X=    600.0, Y=    200.0)
              -3000.000    -2000.000    -1500.000    -1200.000    -1000.000     -800.000     -600.000     -400.000     -200.000
 Y AXIS (METERS )                                     -  CONCENTRATION  -
             -----------------------------------------------------------------------------------------------------------------

   3000.000    .0190432     .0241329     .0261993     .0276751     .0308195     .0340806     .0373756     .0406059     .0436625
   2000.000    .0172839     .0332538     .0409219     .0440591     .0458115     .0480564     .0568633     .0660506     .0750899
   1500.000    .0145176     .0307911     .0472364     .0562707     .0590068     .0609128     .0630934     .0790168     .0958183
   1200.000    .0161714     .0269201     .0430171     .0574824     .0668912     .0682593     .0677909     .0760994     .1004186
   1000.000    .0178338     .0246244     .0377472     .0511335     .0622083     .0711291     .0680443     .0645042     .0919044
    800.000    .0195119     .0285906     .0325182     .0413520     .0502728     .0596098     .0635159     .0523975     .0666619
    600.000    .0211640     .0326632     .0389586     .0398198     .0372055     .0396533     .0418363     .0330761     .0242003
    400.000    .0227447     .0366582     .0455539     .0481257     .0459800     .0387825     .0256947     .0104431     .0012453
    200.000    .0232699     .0380372     .0479793     .0513804     .0496649     .0424477     .0282529     .0084008     .0000107
       .000    .0208492     .0320886     .0382310     .0390262     .0363950     .0300802     .0220030     .0107529     .0045915
   -200.000    .0183616     .0260795     .0286371     .0271096     .0287119     .0287696     .0254763     .0208950     .0444946
   -400.000    .0150753     .0202893     .0226584     .0267263     .0289653     .0300520     .0295511     .0287087     .0814524
   -600.000    .0134495     .0164962     .0222508     .0262182     .0286626     .0300090     .0307392     .0428667     .0929428
   -800.000    .0111351     .0161544     .0215302     .0252826     .0270721     .0284245     .0295135     .0523987     .0898768
  -1000.000    .0094561     .0156637     .0205777     .0233066     .0247897     .0260291     .0289585     .0537782     .0812568
  -1200.000    .0093154     .0150638     .0193073     .0211963     .0223565     .0233663     .0323321     .0512391     .0714642
  -1500.000    .0090276     .0140417     .0167713     .0180820     .0189857     .0207909     .0322569     .0449514     .0580672
  -2000.000    .0084253     .0117110     .0131391     .0138345     .0150694     .0210760     .0276670     .0345949     .0415338
  -3000.000    .0068734     .0079802     .0084171     .0111487     .0135093     .0160002     .0195703     .0211581     .0236952

                                                 - GRID SYSTEM X AXIS (METERS) -
                        (THE MAXIMUM CONCENTRATION IS      .2147621 AT X=    600.0, Y=    200.0)
                   .000      200.000      400.000      600.000      800.000     1000.000     1200.000     1500.000     2000.000
 Y AXIS (METERS )                                     -  CONCENTRATION  -
             -----------------------------------------------------------------------------------------------------------------

   3000.000    .0429699     .0392437     .0335001     .0287787     .0242047     .0198794     .0197397     .0204912     .0205558
   2000.000    .0735207     .0613859     .0492352     .0376929     .0392304     .0411641     .0418307     .0410601     .0372698
   1500.000    .0941190     .0737720     .0540240     .0605580     .0654326     .0667199     .0652628     .0601635     .0504963
   1200.000    .0990794     .0743890     .0737302     .0871221     .0921383     .0895716     .0842551     .0748618     .0597988
   1000.000    .0936539     .0675800     .0960477     .1128297     .1131446     .1071271     .0989368     .0857342     .0677578
    800.000    .0710226     .0799367     .1254596     .1307890     .1357877     .1264064     .1146709     .0994363     .0769208
    600.000    .0273219     .0835087     .1454502     .1642110     .1609656     .1507654     .1367361     .1152825     .0860266
    400.000    .0009643     .0539620     .1637720     .2006073     .1963812     .1790868     .1598710     .1305637     .0946507
    200.000    .0000143     .0440459     .1740476     .2147621     .2085134     .1887710     .1664907     .1358996     .0977377
       .000    .0100637     .0667123     .1215263     .1453759     .1532392     .1467553     .1346583     .1145271     .0859629
   -200.000    .0721092     .0964831     .1242486     .1267731     .1181804     .1063021     .1030961     .0927714     .0737417
   -400.000    .1077633     .0991850     .1140541     .1184107     .1095880     .0984109     .0868032     .0721091     .0616760
   -600.000    .1115735     .0948897     .0972306     .1020145     .1003247     .0905774     .0806460     .0670126     .0502666
   -800.000    .1024733     .0879460     .0799182     .0843763     .0854843     .0824599     .0741335     .0625294     .0470566
  -1000.000    .0898718     .0793745     .0662361     .0690203     .0709367     .0705756     .0676353     .0579087     .0445134
  -1200.000    .0775104     .0696664     .0592277     .0563035     .0585435     .0591426     .0584438     .0533486     .0418843
  -1500.000    .0619100     .0559510     .0494195     .0429081     .0441674     .0454571     .0457868     .0449198     .0379717
  -2000.000    .0434275     .0401675     .0366109     .0329295     .0292795     .0299563     .0309474     .0315350     .0308236
  -3000.000    .0243545     .0231166     .0217716     .0203551     .0189028     .0174478     .0160191     .0165963     .0176345
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FIGURE D-2. (Continued)

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        EXAMPLE LONG TERM PROBLEM
                                                                                      DATE 061782, PAGE   43
                                                  TABLE   12 (CONT)
          ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        2
                                             - GRID SYSTEM X AXIS (METERS) -
                       (THE MAXIMUM CONCENTRATION IS       .2147621 AT X=    600.0, Y=     200.0)
              3000.000)
Y AXIS (METERS )
          -                                            -  CONCENTRATION  -
          ------------------------------------------------------------------------------------------------

      3000.000       .0185049
      2000.000       .0285278
      1500.000       .0349751
      1200.000       .0405079
      1000.000       .0442796
       800.000       .0480093
       600.000       .0516367
       400.000       .0550611
       200.000       .0563480
          .000       .0517920
      -200.000       .0470327
      -400.000       .0421954
      -600.000       .0374055
      -800.000       .0327494
     -1000.000       .0283191
     -1200.000       .0269240
     -1500.000       .0253477
     -2000.000       .0228022
     -3000.000       .0176654

                                       *-* DISCRETE POINT RECEPTORS *-*
                         (THE MAXIMUM CONCENTRATION IS       .2139120 AT X=    800.0, Y=     300.0)
  X            Y       CONCENTRATION         X           Y       CONCENTRATION          X           Y       CONCENTRATION
          ------------------------------------------------------------------------------------------------

 -800.0      700.0      .0500555        -600.0       700.0      .0550948         -400.0      700.0      .0437370
 -200.0      700.0      .0463755            .0       700.0      .0520712          200.0      700.0      .0852243
  400.0      700.0      .1379059         600.0       700.0      .1513973          900.0      700.0      .1476888
  800.0      500.0      .1785241         800.0       300.0      .2139120          900.0      100.0      .1807114
  800.0     -100.0      .1263926         800.0      -300.0      .1140771          300.0     -500.0      .1050808
  600.0     -500.0      .1113578         400.0      -500.0      .1059080          200.0     -500.0      .0959070
     .0     -500.0      .1122248        -200.0      -500.0      .0897898         -400.0     -500.0      .0332878
 -600.0     -500.0      .0305217        -800.0      -500.0      .0302874         -900.0     -300.0      .0294744
 -800.0     -100.0      .0280601        -800.0       100.0      .0361094         -300.0      300.0      .0433176
 -800.0      500.0      .0347287
```

FIGURE D-2. (Continued)

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EXAMPLE LONG TERM PROBLEM                                                                                    DATE 061782, PAGE   56

                                                        TABLE   17

              ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        3
                                                - GRID SYSTEM X AXIS (METERS) -
                             (THE MAXIMUM CONCENTRATION IS      .1453713 AT X=    800.0, Y=    400.0)
                   -3000.000    -2000.000    -1500.000    -1200.000    -1000.000     -800.000     -600.000     -400.000     -200.000
 Y AXIS (METERS )
                                                          -  CONCENTRATION  -
          -----------------------------------------------------------------------------------------------------------------------

    3000.000       .0060999     .0087896     .0097791     .0103435     .0106831     .0114739     .0128437     .0142459     .0156429
    2000.000       .0052372     .0102328     .0151062     .0172815     .0185376     .0197405     .0208093     .0231258     .0276411
    1500.000       .0050509     .0090071     .0144202     .0196785     .0244209     .0276210     .0299170     .0318091     .0362242
    1200.000       .0058043     .0092527     .0125927     .0178806     .0229496     .0297117     .0369295     .0396014     .0409929
    1000.000       .0063166     .0095058     .0117984     .0153881     .0201556     .0267449     .0356448     .0444734     .0448374
     800.000       .0068241     .0107994     .0140936     .0164281     .0179756     .0211131     .0296996     .0382996     .0448246
     600.000       .0073145     .0120752     .0164103     .0199384     .0224784     .0247035     .0255286     .0232999     .0277728
     400.000       .0077752     .0132727     .0186730     .0233477     .0270510     .0307652     .0331034     .0311651     .0219355
     200.000       .0073434     .0122157     .0167792     .0205272     .0233205     .0258595     .0269569     .0244990     .0166874
        .000       .0065952     .0103612     .0134178     .0155856     .0169362     .0174495     .0174993     .0190924     .0180441
    -200.000       .0058338     .0085058     .0102017     .0109060     .0122339     .0144828     .0168660     .0188932     .0198783
    -400.000       .0050799     .0067292     .0078238     .0098923     .0115109     .0133905     .0157300     .0175708     .0190469
    -600.000       .0043442     .0053725     .0075255     .0093532     .0109326     .0125065     .0140659     .0155320     .0168227
    -800.000       .0036419     .0052258     .0071518     .0087441     .0099895     .0111498     .0122862     .0133893     .0189368
   -1000.000       .0030570     .0050460     .0067520     .0081125     .0089595     .0097943     .0106370     .0114272     .0187797
   -1200.000       .0030135     .0049444     .0063490     .0073354     .0079474     .0085746     .0091853     .0108888     .0175079
   -1500.000       .0029239     .0045214     .0056243     .0062219     .0065308     .0070312     .0074019     .0107156     .0150825
   -2000.000       .0027548     .0039117     .0044120     .0047629     .0049666     .0051520     .0069136     .0091217     .0114765
   -3000.000       .0023394     .0027258     .0029069     .0029985     .0035817     .0044640     .0052945     .0061581     .0070356

                                                - GRID SYSTEM X AXIS (METERS) -
                             (THE MAXIMUM CONCENTRATION IS      .1453713 AT X=    800.0, Y=    400.0)
                        .000      200.000      400.000      600.000      800.000     1000.000     1200.000     1500.000     2000.000
 Y AXIS (METERS )
                                                          -  CONCENTRATION  -
          -----------------------------------------------------------------------------------------------------------------------

    3000.000       .0169037     .0182156     .0163172     .0143289     .0123205     .0103571     .0094913     .0079140     .0081210
    2000.000       .0322126     .0354618     .0306003     .0245041     .0185288     .0170834     .0178099     .0178131     .0161763
    1500.000       .0461521     .0559198     .0436927     .0313805     .0293866     .0312869     .0312152     .0288452     .0234062
    1200.000       .0532036     .0702843     .0511167     .0395290     .0463813     .0475123     .0446215     .0384313     .0288226
    1000.000       .0511136     .0750277     .0513127     .0562599     .0643399     .0620611     .0559018     .0460051     .0333198
     800.000       .0377354     .0652475     .0471154     .0925258     .0867096     .0790800     .0697592     .0552611     .0386304
     600.000       .0216732     .0243159     .0537321     .1065765     .1100964     .1002275     .0858589     .0661419     .0438383
     400.000       .0046856     .0000000     .0356154     .1399397     .1453713     .1250927     .1029707     .0762000     .0485762
     200.000       .0059074     .0047777     .0443347     .0967751     .1114783     .1025378     .0880073     .0677114     .0447090
        .000       .0150577     .0601458     .0667480     .0860539     .0805553     .0605312     .0625098     .0527288     .0377099
    -200.000       .0270393     .0823906     .0665759     .0716292     .0711361     .0613630     .0515040     .0391640     .0307064
    -400.000       .0376895     .0744744     .0607720     .0548761     .0565742     .0536328     .0459501     .0359453     .0242377
    -600.000       .0374626     .0610349     .0512503     .0409892     .0433141     .0431273     .0403912     .0325164     .0227140
    -800.000       .0335501     .0439667     .0422100     .0346669     .0330932     .0337893     .0331566     .0291464     .0210958
   -1000.000       .0289951     .0394234     .0347127     .0293969     .0255181     .0266097     .0266995     .0255548     .0194696
   -1200.000       .0249129     .0321147     .0287566     .0249465     .0210614     .0211513     .0216203     .0212790     .0178968
   -1500.000       .0197039     .0242394     .0221206     .0197139     .0172035     .0153155     .0159976     .0162931     .0155046
   -2000.000       .0139761     .0161994     .0150991     .0138563     .0125358     .0111997     .0101453     .0107632     .0109751
   -3000.000       .0079051     .0097433     .0093168     .0078870     .0074059     .0069059     .0063993     .0056496     .0058956
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FIGURE D-2. (Continued)

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       EXAMPLE LONG TERM PROBLEM                                                                              DATE 061782. PAGE   57
                                                                      TABLE   17 (CONT)
     ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES       3
                                                             - GRID SYSTEM X AXIS (METERS) -
                                         (THE MAXIMUM CONCENTRATION IS       .1453713 AT X=    800.0, Y=    400.0)
                  3000.000
 Y AXIS (METERS )                                                   -  CONCENTRATION  -
         ---------------------------------------------------------------------------------------------------------------

    3000.000      .0073237
    2000.000      .0119573
    1500.000      .0150218
    1200.000      .0176884
    1000.000      .0195053
     800.000      .0212983
     600.000      .0230113
     400.000      .0245075
     200.000      .0233490
        .000      .0210860
    -200.000      .0187553
    -400.000      .0164336
    -600.000      .0141740
    -800.000      .0120419
   -1000.000      .0114920
   -1200.000      .0109954
   -1500.000      .0102295
   -2000.000      .0089054
   -3000.000      .0062050


                                                        *-* DISCRETE POINT RECEPTORS *-*
                                    (THE MAXIMUM CONCENTRATION IS       .1399609 AT X=    800.0, Y=    300.0)
     X           Y      CONCENTRATION          X           Y      CONCENTRATION          X           Y      CONCENTRATION
          ---------------------------------------------------------------------------------------------------------------

   -800.0       700.0       .0216901        -600.0       700.0       .0235102        -400.0       700.0       .0314402
   -200.0       700.0       .0383948            .0       700.0       .0312534         200.0       700.0       .0495308
    400.0       700.0       .0537079         600.0       700.0       .0961874         800.0       700.0       .0982341
    800.0       500.0       .1275978         800.0       300.0       .1399609         800.0       100.0       .0848175
    800.0      -100.0       .0753626         800.0      -100.0       .0643101         300.0      -500.0       .0495902
    600.0      -500.0       .0474824         400.0      -500.0       .0561327         200.0      -500.0       .0677904
       .0      -500.0       .0301644        -200.0      -500.0       .0133197        -400.0      -500.0       .0165931
   -600.0      -500.0       .0149580        -800.0      -500.0       .0130633        -800.0      -300.0       .0140704
   -800.0      -100.0       .0143085        -800.0       100.0       .0219944        -800.0       300.0       .0301271
   -800.0       500.0       .0277574
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FIGURE D-2.   (Continued)

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      EXAMPLE LONG TERM PROBLEM                                                                                          DATE 061782, PAGE   70

                                                               TABLE   22

             ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        4     -6
                                                     - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS     7.2626314 AT X=        0, Y=     200.0)
                       -3000.000    -2000.000    -1500.000    -1200.000    -1000.000     -800.000     -600.000     -400.000     -200.000
 Y AXIS (METERS )                                                   -  CONCENTRATION  -
              ---------------------------------------------------------------------------------------------------------------------

    3000.000      .1001413     .1273044     .1434786     .1583694     .1671300     .1732683     .1844741     .1953981     .2095746
    2000.000      .1015832     .1849181     .2127542     .2369507     .2603770     .2935262     .3183200     .3346033     .3717327
    1500.000      .0963392     .1793244     .2813926     .3217283     .3513249     .4161722     .4667258     .5175734     .5652893
    1200.000      .1023260     .1763367     .2854418     .3956212     .4519510     .5202100     .6157927     .7051040     .8000198
    1000.000      .0968039     .1837603     .2743777     .4236982     .5233561     .5273392     .7696197     .8927491    1.0558734
     800.000      .1010517     .1956732     .2865334     .4034734     .5683959     .7338402     .9658641    1.1716807    1.4253546
     600.000      .1092993     .1842914     .3210494     .4392124     .5697102     .9294047    1.1764479    1.6398245    2.0105259
     400.000      .1164230     .1954204     .3031613     .4751588     .6480193     .9167334    1.3863701    2.2288543    3.2286666
     200.000      .1236696     .2153039     .3236190     .4493673     .6229654     .9435049    1.5977675    3.2179825    5.6923841
        .000      .1369063     .2493750     .3002477     .5407089     .7220800     .9944199    1.6074509    3.0923625    2.6420576
    -200.000      .1157676     .1979214     .2934413     .3983103     .5201506     .7237161    1.0813574    1.9102821    3.6460410
    -400.000      .1044102     .1697725     .2469349     .3457683     .4317395     .5415619     .6911977    1.3859942    1.8490452
    -600.000      .0937429     .1466207     .2161448     .2576483     .2941426     .3794517     .5196094     .7747602    1.1368915
    -800.000      .0830012     .1316911     .1560232     .1927343     .2519755     .3082290     .4174575     .5636082     .8182525
   -1000.000      .0734057     .1017166     .1316324     .1840305     .2181509     .2566793     .3372903     .4438384     .6193300
   -1200.000      .0679723     .0933285     .1271223     .1638574     .1807527     .2143712     .2788592     .3637273     .4798864
   -1500.000      .0523953     .0817971     .1160385     .1269854     .1393679     .1788526     .2225417     .2777672     .3459183
   -2000.000      .0483776     .0758435     .0830726     .0938913     .1129093     .1349580     .1615675     .1867826     .2271603
   -3000.000      .0436000     .0492403     .0566570     .0681793     .0773684     .0860592     .0970767     .1083919     .1235241

                                                     - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS     7.2626314 AT X=        0, Y=     200.0)
                            .000      200.000      400.000      600.000      800.000     1000.000     1200.000     1500.000     2000.000
 Y AXIS (METERS )                                                   -  CONCENTRATION  -
              ---------------------------------------------------------------------------------------------------------------------

    3000.000      .2084212     .1975875     .1740439     .1564915     .1393119     .1268104     .1141896     .0994846     .0914290
    2000.000      .3712415     .3463417     .2893914     .2589803     .2274956     .2034184     .1796961     .1674393     .1726839
    1500.000      .5651725     .5204625     .4378376     .3754549     .3277997     .2799759     .2735982     .2776494     .2259505
    1200.000      .7776147     .7336131     .5929382     .4995674     .4313213     .4002952     .4023353     .3482466     .2686575
    1000.000     1.3111198     .9566264     .7475302     .6449546     .5705470     .5417352     .4955507     .3938942     .3218361
     800.000     1.4247023    1.2920320    1.0126960     .8358873     .7712021     .5919558     .5738645     .4913236     .4101755
     600.000     2.1113196    1.8838835    1.5367937    1.2515395    1.0534037     .8011709     .7946158     .5657851     .4368843
     400.000     3.6187124    3.2513676    2.4588548    1.9134816    1.5904107    1.2940685    1.0327690     .7221396     .4750164
     200.000     7.2626314    6.7959938    4.8092940    3.0427485    2.0593341    1.4657391    1.1062136     .7973575     .5209101
        .000     5.7629929    5.9654953    7.1137960    3.9463701    2.5202444    1.8248926    1.3790720     .9675695     .6095494
    -200.000     5.4172853    5.7465124    4.5743311    2.8967405    1.9297234    1.3676705    1.0325982     .7506633     .4964318
    -400.000     2.5369134    2.7341756    2.3556986    1.8604323    1.4948735    1.1920056     .9424827     .6575294     .4387487
    -600.000     1.4530077    1.5657023    1.4830248    1.2576386    1.0415857     .9353448     .7324676     .5010294     .3928246
    -800.000      .3757536    1.0431882     .9601582     .9886263     .8003534     .5954852     .5531519     .4524232     .3666116
   -1000.000      .6089211     .7548569     .6038368     .6536332     .6079808     .5701869     .5068222     .3801297     .2917370
   -1200.000      .5287903     .5621441     .5219476     .4911611     .4577811     .4444123     .4294611     .3543340     .2532897
   -1500.000      .3825202     .3873242     .3659147     .3478544     .3343763     .3060275     .3039352     .3012857     .2283927
   -2000.000      .2464945     .2484366     .2242378     .2183107     .2103029     .2066464     .1951130     .1896241     .1930840
   -3000.000      .1306498     .1315433     .1226395     .1155303     .1081912     .1061195     .1044191     .1032138     .1033750
```

FIGURE D-2. (Continued)

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     EXAMPLE LONG TERM PROBLEM
                                                                                         DATE 061782, PAGE   71
                                                       TABLE   22 (CONT)
        ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES        4     -6
                                                 - GRID SYSTEM X AXIS (METERS) -
                             (THE MAXIMUM CONCENTRATION IS     7.2626314 AT X=        0, Y=    200.0)
               3000.000
 Y AXIS (METERS )
                                                     -  CONCENTRATION  -
          ---------------------------------------------------------------------------------------------------------

     3000.000        .0907452
     2000.000        .1329369
     1500.000        .1636009
     1200.000        .2114492
     1000.000        .2209766
      800.000        .2372937
      600.000        .2552890
      400.000        .2723675
      200.000        .2899699
         .000        .3256767
     -200.000        .2806199
     -400.000        .2582361
     -600.000        .2371091
     -800.000        .2154627
    -1000.000        .1963935
    -1200.000        .1873360
    -1500.000        .1484415
    -2000.000        .1323896
    -3000.000        .1073709


                                              *-* DISCRETE POINT RECEPTORS *-*
                            (THE MAXIMUM CONCENTRATION IS     2.2940555 AT X=    800.0, Y=    100.0)
     X          Y      CONCENTRATION         X          Y      CONCENTRATION        X          Y      CONCENTRATION
            -----------------------------------------------------------------------------------------------------------

   -800.0     700.0      .7695545         -600.0     700.0     1.0574697        -400.0     700.0     1.3721920
   -200.0     700.0     1.6771735             .0     700.0     1.7224656         200.0     700.0     1.5260008
    400.0     700.0     1.2210786          600.0     700.0     1.0287999         800.0     700.0      .8865934
    800.0     500.0     1.2490251          800.0     300.0     1.8757826         800.0     100.0     2.2940555
    800.0    -100.0     2.2237931          800.0    -300.0     1.7455491         800.0    -500.0     1.1984510
    600.0    -500.0     1.4730595          400.0    -500.0     1.8034916         200.0    -500.0     2.0276574
       .0    -500.0     1.8693347         -200.0    -500.0     1.4235151        -400.0    -500.0      .8962560
   -600.0    -500.0      .5754534         -800.0    -500.0      .4309813        -800.0    -300.0      .6384920
   -800.0    -100.0      .8572147         -800.0     100.0      .9532369        -800.0     300.0      .9456299
   -800.0     500.0      .8464675
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FIGURE D-2. (Continued)

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EXAMPLE LONG TERM PROBLEM
                                                                                                                DATE 061782, PAGE   94
                                                               TABLE   27
                 ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES          1      -6
                                                      - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS      7.4253400 AT X=     400.0, Y=       .0)
                   -3000.000    -2000.000    -1500.000    -1200.000    -1000.000     -800.000     -600.000     -400.000     -200.000
Y AXIS (METERS )
                 ----------------------------------------- - CONCENTRATION - ----------------------------------------------------------

    3000.000      .1990657     .2339503     .2503234     .2860522     .3070196     .3251457     .3497753     .3717476     .3853224
    2000.000      .1899013     .3293483     .3723505     .4009983     .4405051     .4910086     .5421364     .5857065     .6273391
    1500.000      .1703482     .3233559     .4562243     .5053636     .5379335     .6215876     .6950676     .7855381     .8445591
    1200.000      .1687624     .3015344     .4540226     .5729508     .6339373     .7069010     .8272469     .9497831    1.0622729
    1000.000      .1644625     .2916110     .4226763     .5805163     .6853444     .7911364     .9493234    1.0961528    1.2814147
     800.000      .1780759     .2963129     .4102960     .5385255     .6905649     .8597312    1.1006050    1.3154096    1.5869306
     600.000      .1942466     .2843009     .4314387     .5494428     .6693074     .9101032    1.2589505    1.7142298    2.0866199
     400.000      .2100790     .3099804     .4115315     .5758527     .7407794     .9972006    1.4489301    2.2732151    3.2536339
     200.000      .2240435     .3395419     .4300349     .5475839     .7075550    1.0153771    1.6532001    3.2508836    5.7090988
        .000      .2405475     .3752037     .4981739     .6330985     .7071246    1.0437571    1.6469594    3.1222078    2.6654932
    -200.000      .2085292     .3047585     .3608589     .4612849     .5727913     .7699785    1.1230061    1.9500712    3.7104422
    -400.000      .1861430     .2575606     .3177796     .4055361     .4850612     .5901016     .7383742    1.1352670    1.9517812
    -600.000      .1645156     .2199055     .2839939     .3199285     .3510630     .4335517     .5727756     .8531861    1.2681836
    -800.000      .1431209     .1974145     .2250273     .2570231     .3154946     .3706231     .4921032     .6897472     .9927802
   -1000.000      .1239145     .1656229     .1996413     .2530943     .2800369     .3271721     .4437436     .6166759     .8322252
   -1200.000      .1141112     .1500071     .1946384     .2357930     .2549201     .3004024     .4177680     .5691525     .7154350
   -1500.000      .0959031     .1394722     .1831346     .1997849     .2161145     .2900052     .3875999     .5021167     .5882520
   -2000.000      .0872437     .1284424     .1453435     .1610149     .2065244     .2636700     .3292642     .3946728     .4429547
   -3000.000      .0749910     .0914427     .1092032     .1423749     .1601430     .1941231     .2227202     .2514804     .2686869

                                                      - GRID SYSTEM X AXIS (METERS) -
                                  (THE MAXIMUM CONCENTRATION IS      7.4253400 AT X=     400.0, Y=       .0)
                        .000      200.000      400.000      600.000      800.000     1000.000     1200.000     1500.000     2000.000
Y AXIS (METERS )
                 ----------------------------------------- - CONCENTRATION - ----------------------------------------------------------

    3000.000      .3752447     .3513194     .3113960     .2775693     .2445450     .2235037     .2117419     .1999666     .1932874
    2000.000      .6123895     .5619407     .4703250     .4230635     .3969463     .3790720     .3615704     .3503169     .3449046
    1500.000      .8331312     .7590502     .6533979     .6054023     .5752923     .5399592     .5357212     .5297492     .4504559
    1200.000     1.0346095     .9775761     .8537389     .7998227     .7531777     .7371356     .7246752     .6511468     .5292372
    1000.000     1.2339535    1.2031451    1.0403102     .9944886     .9489507     .9211931     .8645670     .7337087     .6096698
     800.000     1.5847397    1.5340314    1.3340971    1.2957323    1.2079660    1.1257130     .9899999     .8730735     .7296722
     600.000     2.1899593    2.0656236    1.8737367    1.7127618    1.5509556    1.3779298    1.2706944    1.0970129     .7883629
     400.000     3.5339295    3.3549474    2.7796946    2.4420191    2.1739375    1.9607012    1.5743276    1.2024786     .8572555
     200.000     7.2714142    6.0777025    5.1409493    3.5576075    2.6431209    2.0539750    1.6674301    1.2980719     .9190174
        .000     5.7891917    6.1295618    7.4253400    4.4049448    3.0569108    2.3669747    1.9105376    1.4545514    1.0042693
    -200.000     5.5180396    5.9526003    4.0665702    3.2707235    2.3649601    1.9130741    1.4775935    1.1660065     .8482160
    -400.000     2.5955590    2.9563293    2.6343985    2.1877462    1.8637639    1.5701425    1.3229286    1.0139208     .7473343
    -600.000     1.5406994    1.8046443    1.7601494    1.5653037    1.3732620    1.1670051    1.0605423     .9146457     .6636507
    -800.000     1.1854496    1.2964803    1.2306914    1.2020602    1.1087855    1.0069430     .8546370     .7284070     .6083274
   -1000.000      .9183038    1.0019420     .9400937     .9304075     .8926520     .8577569     .7096072     .6405432     .5082895
   -1200.000      .7686010     .7997325     .7650930     .7441093     .7203242     .7086596     .6001910     .5970669     .4591022
   -1500.000      .6196220     .6091012     .5824926     .5657493     .5502366     .5334003     .5320289     .5184180     .4175098
   -2000.000      .4538497     .4416793     .3994937     .3871466     .3794514     .3776122     .3673080     .3622559     .3520514
   -3000.000      .2705318     .2638382     .2457143     .2293213     .2125428     .2065356     .2047772     .2050170     .2065004
```

FIGURE D-2. (Continued)

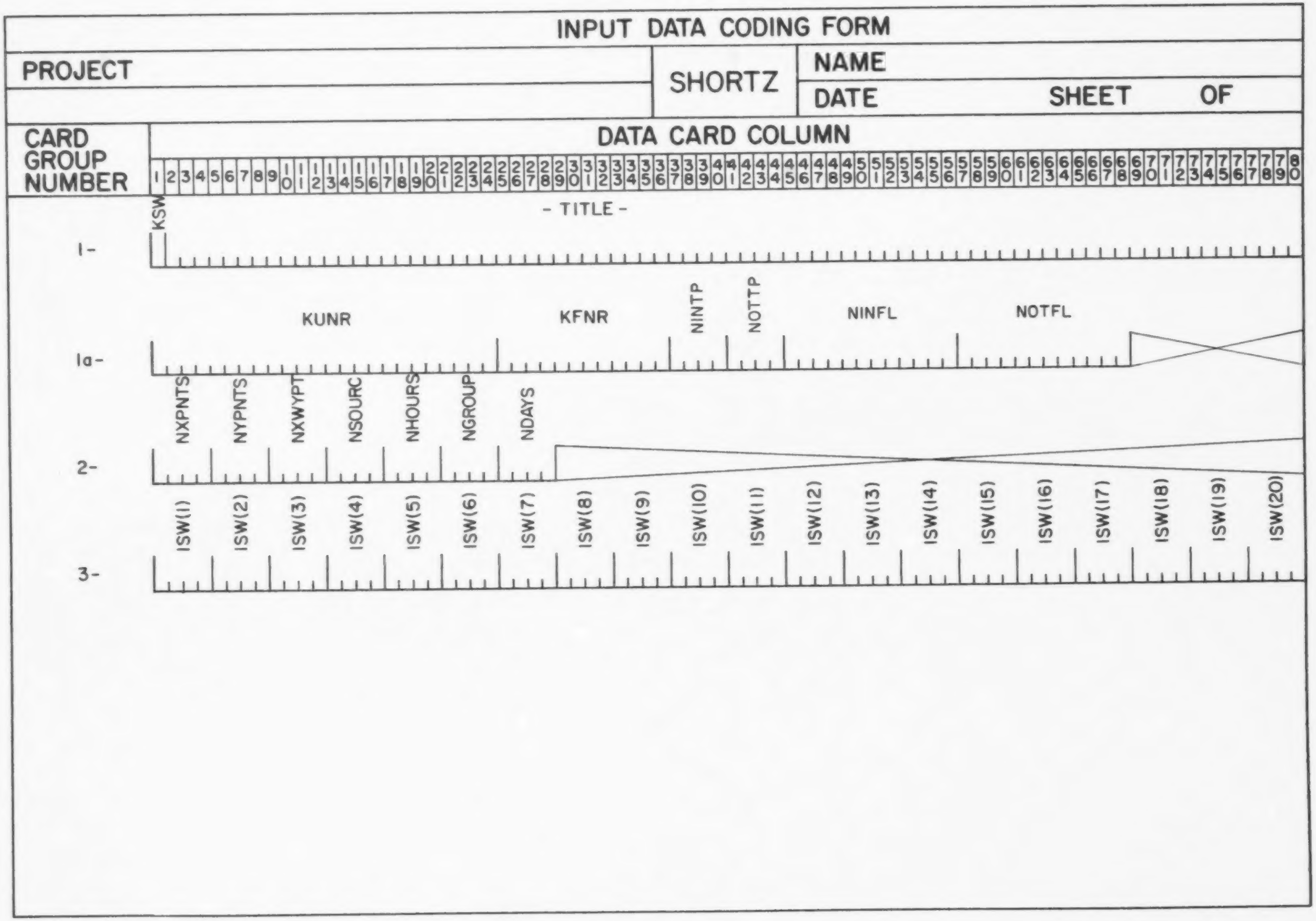
```
          EXAMPLE LONG TERM PROBLEM
                                                                                                   DATE 061782, PAGE   85
                                                          TABLE   27 (CONT)
        ANNUAL GROUND LEVE. CONCENTRATION (MICROGRAMS/CUBIC METER) DUE TO SOURCES         1       -6
                                                  - GRID SYSTEM X AXIS (METERS) -
                         (THE MAXIMUM CONCENTRATION IS      7.4250430 AT X=    400.0, Y=          .0)
              3000.000
 Y AXIS (METERS )
            ---------------------------------------------------   -  CONCENTRATION  -   ---------------------------------------

    3000.000        .1844342
    2000.000        .2723699
    1500.000        .3314312
    1200.000        .4003540
    1000.000        .4245756
     800.000        .4554993
     600.000        .4877396
     400.000        .5103743
     200.000        .5440574
        .000        .5802902
    -200.000        .5171169
    -400.000        .4759436
    -600.000        .4357765
    -800.000        .3952297
   -1000.000        .3591030
   -1200.000        .3364293
   -1500.000        .2826817
   -2000.000        .2533596
   -3000.000        .2021090

                                                   *-* DISCRETE POINT RECEPTORS *-*
                          (THE MAXIMUM CONCENTRATION IS      2.0306719 AT X=    800.0, Y=    100.0)
      X          Y      CONCENTRATION           X          Y      CONCENTRATION           X          Y      CONCENTRATION
            --------------------------------------------------------------------------------------------------------

   -800.0      700.0       .8757042         -600.0      700.0     1.1620939         -400.0      700.0     1.4808623
   -200.0      700.0      1.7937733             .0      700.0     1.6467843          200.0      700.0     1.7492737
    400.0      700.0      1.5579585          600.0      700.0     1.4662971          900.0      700.0     1.3529981
    800.0      500.0      1.7974820          800.0      300.0     2.4823100          800.0      100.0     2.0306719
    800.0     -100.0      2.6963878          800.0     -300.0     2.1473806          900.0     -500.0     1.5402523
    600.0     -500.0      1.7919998          400.0     -500.0     2.0810941          200.0     -500.0     2.2565595
       .0     -500.0      2.0441903         -200.0     -500.0     1.5397504         -400.0     -500.0      .9550226
   -600.0     -500.0       .6255854         -800.0     -500.0      .4816940         -900.0     -300.0      .6857554
   -800.0     -100.0       .9323095         -800.0      100.0     1.0133670         -900.0      300.0     1.0242607
   -800.0      500.0       .9245732
 **BRKPT PRINT*
```

FIGURE D-2. (Continued)

APPENDIX E

CODING FORMS FOR CARD INPUT TO THE SHORT-TERM MODEL (SHORTZ) COMPUTER PROGRAM

This appendix contains blank coding forms for the card input data for the short-term (SHORTZ) program. The card group numbers and input data parameter names correspond to those used in Section 3.2.3.a. The solid vertical lines on the coding forms define the column fields for the various input parameters and the "x-ed" areas show where data are ignored by the program. With the exception of the source data coding forms (Card Groups 9a and 10) and Card Groups 11 and 11a, the coding forms are presented in the same order that the program expects for the input data. The coding forms for Card Groups 9a, 10, 11 and 11a are ordered as shown to facilitate key punching of the data. These cards must be rearranged prior to input to the program. *If the parameter NS is greater than zero for a given source, Card Group 10 must follow Card Group 9a for the source. Additionally, each occurrence of Card Group 11 must be followed by n occurrences of Card Group 11a, where n is the total number of sources from Card Group 9a with the parameter JFLG greater than zero.* An example use of the SHORTZ coding forms is shown in Appendix C for the SHORTZ example problem.



INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1- KSW - TITLE -

1a- KUNR KFNR NINTP NOTTP NINFL NOTFL

2- NXPNTS NYPNTS NXWYPT NSOURC NHOURS NGROUP NDAYS

3- ISW(1) ISW(2) ISW(3) ISW(4) ISW(5) ISW(6) ISW(7) ISW(8) ISW(9) ISW(10) ISW(11) ISW(12) ISW(13) ISW(14) ISW(15) ISW(16) ISW(17) ISW(18) ISW(19) ISW(20)

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- X (axis of grid system, omit if NXPNTS = 0 or KSW = 1 or 3) -

4-

- X (arbitrarily placed receptors, omit if NXWYPT = 0 or KSW = 1 or 3) -

4a-

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- X (arbitrarily placed receptors, continued) -

4a (Cont.)

- Y (axis of grid system, omit if NYPNTS = 0 or KSW = 1 or 3) -

5-

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Y (arbitrarily placed receptors, omit if NXWYPT = 0 or KSW = 1 or 3) -

5a-

- ZZ (grid system elevations, omit if ISW(7) = 0 or KSW = 1 or 3 or NXPNTS = 0) -

5b-

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER	DATA CARD COLUMN
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
5b- (Cont.)	- ZZ (grid system elevations, continued) -

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE

SHEET

OF

CARD GROUP NUMBER

DATA CARD COLUMN

- ZZ (arbitrarily placed receptors, omit if ISW(7) = 0, NXWYPT = 0, KSW = 1 or 3) -

5c-

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE

SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- (omit if KSW = 1 or 3) -

6- ROTATE TK HA UTMX UTMY G ZR GAMMA1 GAMMA2 DECAY XRY

- NSOGRP (array, omit if NGROUP = 0) -

7-

- IDSOR (array, omit if NGROUP = 0) -

8-

- SFMT (omit if NSOURC = 0 or ISW(12) = 0) -

9-

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER	DATA CARD COLUMN													
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80													
								- (omit if NSOURC=0) -						
	NUMSQ	TYPE	DISP	JFLG	Q	DX	DY	H	HS	TS or SI	VOL or S2	DTH	RDS	NS
**9a-														

** This form shows the default format for Card Group 9a.

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- VS, FRQ (include only if one or more sources in Card Group 9a have NS>0) -

*10-

*Each occurrence of Card Group 10 must immediately follow it's associated source card (Card Group 9a) in the input deck.

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- (omit if KSW=1 or 3) -

CARD GROUP NUMBER	HOUR	THETA	UBAR	HM	TA	DPDZ	ISTBLE	P	SIGEPU	SIGAPU	SIGEPL	SIGAPL	ALPHA
11-													

INPUT DATA CODING FORM

PROJECT

SHORTZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- (include only if one or more sources in Card Group 9a have JFLG = 1) -

*11a-	NUMSQB	QB	TSB	VOLB

*There must be one of these cards for each source card (Card Group 9a) in which JFLG = 1. One set of these cards must immediately follow each occurrence of Card Group 11 in the input deck.

APPENDIX F

CODING FORMS FOR CARD INPUT TO THE LONG-TERM MODEL (LONGZ) COMPUTER PROGRAM

The coding forms shown in this appendix are used to prepare the input data for the LONGZ program for card punching. If any input card has all zero values, it may be left blank because the program interprets blanks as zero. The coding forms are presented in the same order as the program expects the input data except for the source input coding forms. The source input coding forms show a form for Card Groups 18a, 18b and 18c individually. This is done to make the key punching of the source data easier and to minimize the number of coding forms that must be filled out. When the source card data have been punched, *the user must reorder the source input cards in sets from Card Groups 18a through 18c, one set for each successive source.* An example use of these card input forms is shown in Appendix D for the LONGZ example problem.

INPUT DATA CODING FORM

PROJECT	LONGZ	NAME
		DATE SHEET OF

CARD GROUP NUMBER	DATA CARD COLUMN 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
1-	TITLE
2-	NSOURC NGROUP NXPNTS NYPNTS NXWYPT NSEASN NSTBLE NSORX NSPEED NSCTOR NSTOP LUNT LKNT
3-	ISW(1) ISW(2) ISW(3) ISW(4) ISW(5) ISW(6) ISW(7) ISW(8) ISW(9) ISW(10) ISW(11) ISW(12) ISW(13) ISW(14) ISW(15) ISW(16) ISW(17) ISW(18) ISW(19) ISW(20) NINTP NOTTP NINFL NOTFL
4-	-NSOGRP (array, omit if NGROUP=0)-
5-	-IDSOR (array, omit if NGROUP=0)-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

-X (axis of grid system, omit if NXPNTS = 0 or ISW(1) = 1 or 2)-

6-

-X (arbitrarily placed receptors, omit if NXWYPT = 0 or ISW(1) = 1 or 2)-

6a-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

6a- (Cont.)

-X (arbitrarily placed receptors, continued)-

7-

- Y (axis of grid system, omit if NYPNTS = 0 or ISW(1) = 1 or 2) -

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE

SHEET

OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Y (axis of grid system, continued) -

7-
(Cont.)

- Y (arbitrarily placed receptors, omit if NXWYPT = 0 or ISW(I) = 1 or 2) -

7a-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Z (grid system elevations, omit if ISW(8) = 0 or ISW(1) = 1 or 2 or NXPNTS = 0) -

7b-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Z (grid system elevations, continued) -

7b-
(Cont.)

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Z (arbitrarily placed receptors, omit if ISW(8) = 0, NXWYPT = 0, ISW(1) = 1 or 2) -

7c-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- FMT (omit if ISW(1) = 1 or ISW(11) = 0) -

8-

- FREQ (omit if ISW(1) = 1) -

*8a-

* This form shows the default format for Card Group 8a.

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE

SHEET

OF

CARD GROUP NUMBER	DATA CARD COLUMN
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
	- FREQ (Continued) -
8a - (Cont.)	

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE

SHEET

OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- TA (omit if ISW(I) = I) -

9-

- HM (omit if ISW(I) = I) -

10-

INPUT DATA CODING FORM

PROJECT	LONGZ	NAME
		DATE SHEET OF

CARD GROUP NUMBER	DATA CARD COLUMN
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
10- (Cont.)	- HM (Continued) -
11-	- DPDZ (omit if ISW(I) = I) -

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

12- ROTATE TK HA UTMX UTMY G ZR GAMMA1 GAMMA2 DECAY

- (omit if ISW(1) = 1) -

- SIGEPU (omit if ISW(1) = 1) -

13-

- SIGEPL (omit if ISW(1) = 1 OR ISW(16) = 0) -

14-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE

SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- UBAR (omit if ISW(1) = 1) -

15-

- P (omit if ISW(1) = 1) -

16-

- THETA (omit if ISW(1) = 1) -

17-

- SFMT (omit if NSOURC = 0 or ISW(12) = 0) -

18-

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

DATA CARD COLUMN

CARD GROUP NUMBER	NUMSQI	TYPEI	DISP	QI(1)	QI(2)	QI(3)	QI(4)	DXI	DYI	HI	HSI	TSI OR SII	VOLI OR S2I	RDSI	NVSI
	1–5	6	7	8–17	18–27	28–37	38–47	48–57 (omit if NSOURC = 0)	58–67 (omit if NSOURC = 0)	68–77					

*18a-

* This form shows the default format for Card Group 18a.

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- Q (variable emission rates, include only if one or more sources in Card Group 18a have DISP = 3) -

**18b-

**Each occurrence of Card Group 18b must immediately follow it's associated source card (Card Group 18a) in the input deck.

INPUT DATA CODING FORM

PROJECT

LONGZ

NAME

DATE SHEET OF

CARD GROUP NUMBER

DATA CARD COLUMN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

- VSI, FRQI (include only if one or more sources in Card Group 18a have NVSI>0) -

**18c-

** Each occurrence of Card Group 18c must immediately follow each occurrence of Card Group 18b or follow it's associated source card (Card Group 18a) in the input deck.

APPENDIX G

DEVELOPMENT OF THE SEMI-EMPIRICAL CORRECTION FACTOR FOR DOWNWASH EFFECTS ON PLUME RISE

In most plume rise equations, including those of Briggs (1969, 1970, 1971 and 1972), momentum effects are neglected when calculating buoyant plume rise. There are sound theoretical and empirical reasons to believe that momentum effects are negligible in comparison with buoyancy effects for a hot plume. However, Briggs (1969), Fay, et al., (1970) and others have expressed the belief that their plume rise equations may not be applicable when the ratio of the stack exit velocity w to the mean wind speed $\bar{u}$ is less than 1.5 to 1.2 unless the Froude number Fr is less than about unity. The Froude number Fr, which in essence is the ratio of momentum to buoyancy, is defined by Briggs (1969, p. 6) as

$$Fr = \frac{w^2}{g\left(\frac{T_s - T_a}{T_a}\right) D} \qquad \text{(G-1)}$$

where

T_s = the stack exit temperature ($^\circ$K)

T_a = the ambient air temperature ($^\circ$K)

D = the stack diameter (m)

g = the acceleration due to gravity (m/sec^2)

Thus, a stack with a small Froude number usually has a high heat content. For $w/\bar{u}$ less than 1.2, Briggs (1970) states that "downwash of the plume into the low pressure region in the wake of the stack is likely to occur." The ASME Guide (1973, p.23-25) recommends that a stack should be designed so that $w/\bar{u}$ is greater than or equal to 2 most of the time. It should be noted that the majority of the stacks used to validate the Briggs plume rise equations have either high exit velocities or low Froude numbers, as shown by Table G-1. Thus, any downwash effects on plume rise would not be observed for these stacks except on rare occasion.

During 1974, the H. E. Cramer Company developed a computerized set of short-term and long-term dispersion models for use by the Air Quality Division of the Michigan Department of Natural Resources (DNR). The new programs were then tested by calculating ground-level SO_2 concentrations produced by the major stationary sources in Lansing, Michigan. During the course of the study, we found that visual observations of the behavior of the plumes from a number of stacks did not correspond to the behavior predicted by the Briggs equations when the wind speed approached the stack exit velocities. Observations suggested that, rather than attaining the calculated plume rises, the plumes did not achieve any buoyant rise when the wind speed was greater than or equal to the stack exit velocities. In general, these stacks were characterized by Froude numbers appreciably larger than unity. Our work on the Allegheny County SO_2 study (Cramer, et al., 1975), which resulted in the development of the SHORTZ and LONGZ computer programs, began during the period when we were completing our model testing in Lansing. Visual observations of plume rise for stacks in the Allegheny County area also indicated restrictions on plume rise during periods when the wind speed equalled or exceeded the stack exit velocity.

On the basis of our observations in Lansing and Allegheny County, we hypothesized that plume rise is precluded for most stacks when $w/\bar{u}$ is less than or equal to unity. Following the suggestions of Briggs (1973), we assumed that the exit-velocity effect starts to occur when $w/\bar{u}$ is equal to 1.5. We therefore multiplied the plume rise Δh calculated from the Briggs equations by a factor f defined by

$$f = \left\{ \begin{array}{lc} 1 & ; \quad \bar{u} < w/1.5 \\ \left(\frac{3w - 3\bar{u}}{w}\right) & ; \quad w/1.5 \leq \bar{u} < w \\ 0 & ; \quad w \leq \bar{u} \end{array} \right\} \qquad \text{(G-2)}$$

TABLE G-1

EXIT VELOCITIES AND FROUDE NUMBERS OF STACKS USED TO VALIDATE THE BRIGGS (1969) PLUME RISE EQUATIONS

Source*	Exit Velocities (m/sec)	Froude Number
Harwell A**	9.9	17.6
Harwell B	9.9	17.6
Bosanquett**	9.7	3.0
Darmstadt**	4.8	0.9
Duisburg	8.5	5.6
Tallawarra**	3.7	0.5
Lakeview**	19.8	19.9
CEGB Plants		
Earley	5.6	1.9
Earley	17.1	17.7
Castle Donington	12.5	5.3
Castle Donington	16.7	9.5
Northfleet**	14.1	10.9
Northfleet**	21.3	24.9
TVA Plants		
Shawnee**	14.8	11.9
Colbert**	13.1	7.7
Johnsonville	28.9	43.8
Widows Creek	21.8	18.5
Gallatin	16.0	8.9
Gallatin	7.2	1.5
Paradise	15.6	20.6
Paradise	17.4	8.9

* See Table 5.1 of Briggs (1969) for data references.

** Not included in "selected data" by Briggs (1969) because factors such as low exit velocity, terrain downwash, etc. may affect plume rise.

The expression in Equation (G-2) for $\bar{u}$ between 0.67 w and w is a simple linear interpolation between the two extremes that we hypothesized. (Equation (G-2) corresponds to Equation (2-5) in Section 2.2.) The use of Equation (G-2) in the short-term and long-term dispersion model calculations substantially improved the correspondence between the calculated and observed SO_2 concentration in every case considered in our Lansing and Allegheny County studies. Consequently, Equation (G-2) was included in the urban dispersion model developed for Michigan and in the SHORTZ and LONGZ programs.

We continued to investigate downwash restrictions on plume rise following the completion of the studies in Lansing and Allegheny County. Because additional visual observations of plume behavior indicated that Equation (G-2) did not apply to a limited number of stacks, we analyzed the plume rise data given by Bringfelt (1968) to gain further insight into the downwash problem. The two parameters that we used to characterize each Bringfelt observation were the Froude number and the $w/\bar{u}$ ratio.

Table G-2 lists the stack exit parameters, the mean wind speed $\bar{u}$, the observed plume rise Δh and the Froude number Fr for each trial reported by Bringfelt (1968) in which the $w/\bar{u}$ ratio was less than or equal to unity; several cases with w slightly greater than $\bar{u}$ are also included in the table. It is important to note that, in his analysis of the data, Bringfelt excluded all trials with $w/\bar{u}$ ratios less than unity in order to eliminate the most extreme downwash cases (see p. 583). If the Froude number is not considered, the modified Briggs plume rise equations used by the SHORTZ and LONGZ programs calculate a zero or near zero plume rise for each trial listed in Table G-2.

Table G-3 lists, for each trial in Table G-2, the ratio of the observed final plume rise Δh to the stack height h. For the purpose of dispersion modeling, we will define "significant" plume rise as plume rise that is greater than or equal to 20 percent of the stack height (i.e., $\Delta h/h \geq 0.2$). Following this definition, there are 17 cases of significant rise, eight cases of negligible rise and three cases that may have had significant

TABLE G-2

STACK EXIT PARAMETERS AND FROUDE NUMBERS OF BRINGFELT (1968) TRIALS FOR WHICH $w/\bar{u}$ IS LESS THAN OR EQUAL TO UNITY

Trial	Stack Diameter (m)	Stack Exit Temperature (°C)	Ambient Air Temperature (°C)	Stack Exit Velocity (m/sec)	Mean Wind Speed (m/sec)	Observed Plume Rise (m)	Froude Number
3	3.6	130	0	6.1	8.0	44-56	2.2
4	3.6	110	0	2.5	6.0	20-30	0.4
6	3.6	200	-6	5.1	5.0	81	1.0
7	3.6	136	-15	6.8	6.6	60-80	2.2
8	3.6	130	-11	3.1	3.8	110-130	0.5
10a	4.5	37	-5	7.9	13.0	15-20	9.0
11a	4.5	33	-7	7.7	11.0	10-75	8.9
20a	4.5	45	19	6.2	8.0	53	9.8
20c	2.5	50	19	6.7	7.1	15-26	17.3
21c	2.5	40	15	3.0	3.1	26-34	4.2
22b	2.5	45	14	5.2	5.0	33	10.2
24c	4.0	25	6	4.3	9.0	-1	6.9
27b	2.5	176	3	7.4	7.2	41	3.6
28c	4.0	25	3	4.3	6.6	11	5.9
31	3.0	132	3	3.4	4.5	52-60	0.8
33b	2.9	140	0	3.8	6.6	14	1.0
35	3.0	154	1	3.4	8.4	56-83	0.7
36	10.5	7	1	6.6	6.3	15	19.3
37	2.0	125	1	4.6	6.6	27-64	2.4
39	3.0	125	10	1.9	1.6	115	0.3

TABLE G-2 (Continued)

Trial	Stack Diameter (m)	Stack Exit Temperature (°C)	Ambient Air Temperature (°C)	Stack Exit Velocity (m/sec)	Mean Wind Speed (m/sec)	Observed Plume Rise (m)	Froude Number
43a	1.7	33	15	8.2	8.7	0	64.5
43b	1.6	205	15	5.6	8.3	0	3.0
44a	4.5	44	0	9.7	13.0	16-27	13.2
45a	4.5	60	0	10.0	10.0	12-22	10.3
45c	1.6	300	1	8.7	9.6	44	4.4
46a	4.5	60	4	9.2	12.0	24-33	9.5
46c	2.5	43	4	7.2	11.0	5-10	15.0
47a	3.7	127	-10	7.0	7.9	68-75	2.6

TABLE G-3

RATIOS OF PLUME RISE TO STACK HEIGHT AND FROUDE NUMBERS OF BRINGFELT (1968) TRIALS FOR WHICH $w/\bar{u}$ IS LESS THAN OR EQUAL TO UNITY

Trial	Stack Height h (m)	Observed Plume Rise Δh (m)	$\Delta h/h$	Froude Number	$\Delta h/h \geq 0.2$?
3	80	44-36	0.55-0.70	2.2	Yes
4	80	20-30	0.25-0.38	0.4	Yes
6	80	81	1.01	1.0	Yes
7	80	60-80	0.75-1.00	2.2	Yes
8	80	110-130	1.38-1.63	0.5	Yes
10a	145	15-20	0.10-0.14	9.0	No
11a	145	10-75	0.07-0.52	8.9	Possible
20a	145	53	0.37	9.8	Yes
20c	90	15-26	0.17-0.29	17.3	Possible
21c	90	26-34	0.29-0.38	4.2	Yes
22b	90	33	0.37	10.2	Yes
24c	65	-1	0.00	6.9	No
27b	64	41	0.64	3.6	Yes
28c	65	11	0.17	5.9	No
31	90	52-60	0.58-0.67	0.8	Yes
33b	70	14	0.20	1.0	Yes
35	90	56-83	0.62-0.92	0.7	Yes
36	70	15	0.21	19.3	Yes
37	96	27-64	0.28-0.67	2.4	Yes
39	90	115	1.28	0.3	Yes
43a	122	0	0	64.6	No
43b	71	0	0	3.0	No
44a	145	16-27	0.11-0.19	13.2	No
45a	145	12-22	0.08-0.15	10.3	No
45c	50	44	0.88	4.4	Yes
46a	145	24-33	0.17-0.23	9.5	Possible
46c	90	5-10	0.06-0.11	15.0	No
47a	125	68-75	0.54-0.60	2.6	Yes

rise. For the 17 trials with significant rise, use of the correction factor f would have significantly underestimated the plume stabilization height and hence would have overestimated the maximum ground-level concentration. Of the 17 trials with significant rise, 11 (65 percent) had Froude numbers less than 3.0. The cases of significant rise with Froude numbers greater than 3.0 are Trials 20a, 21c, 22b, 27b, 36 and 45c. Because Trials 20a, 21c, 22b and 45c are based on observations of plumes from the same facility, they may reflect local meteorological and/or topographical influences on plume behavior. Local influences may also have affected Trials 27b and 36.

The results shown in Table G-3 indicate that the correction factor f defined by Equation (G-2) may not be required for stacks with Froude numbers less than about 3.0. Consequently, we used the Bringfelt (1968) data to test this hypothesis. First, we used the unmodified Briggs plume-rise equations to calculate plume rise for each trial. Second, we applied the modified Briggs equations used by SHORTZ and LONGZ to those trials for which the Froude number Fr was greater than or equal to 3.0. Table G-4 lists, for each trial, the calculated and observed plume rises. We point out that some subjective judgments were required in selecting the observed plume rises. In general, the observed plume rise was set equal to the highest observed plume height based on five or more observations. The trials in Table G-4 may be divided into two sets: trials without exit-velocity effects ($w/\bar{u} \geq 1.5$ and/or $Fr < 3.0$) and trials assumed to have exit-velocity effects ($w/\bar{u} < 1.5$ and $Fr \geq 3.0$). The correlation coefficient and root-mean square (rms) error are given in Table G-5 for each set and for the combined data. Table G-5 shows that the unmodified Briggs equations fail when downwash effects apply. If the correction factor f is used in plume rise calculations for these trials, the correspondence between calculated and observed plume rises is essentially the same as obtained for the trials without exit velocity effects. For all trials, use of the modified Briggs equations (where f is applied only if $Fr \geq 3.0$) slightly improves the correlation and decreases the rms error.

TABLE G-4
CALCULATED AND OBSERVED PLUME RISES

Trial	Observed Plume Rise (m)	Calculated Plume Rise (m)	
		Briggs	Modified Briggs
3	50	65	65
4	30	54	54
6	81	95	95
7	80	77	77
8	115	95	95
9	242	95	95
10a*	20	54	0
10b*	40	35	30
11a*	15	62	0
11b	48	44	44
12a*	22	51	32
12b	61	82	82
13	63	67	67
14	33	77	69
15	59	43	43
16a	23	36	36
16b	67	49	49
18	105	67	67
19	113	44	44
20a*	53	70	0
20b	27	95	95
20c*	26	70	0
21a	64	89	89
21b	53	92	92
21c*	26	38	0
22a*	63	99	31
22b*	33	53	6
23	63	94	94
24a*	29	94	49
24b*	7	94	24

*Trials assumed to have downwash effects ($w/\bar{u} < 1.5$ and $Fr \geq 3.0$).

TABLE G-4 (Continued)

Trial	Observed Plume Rise (m)	Calculated Plume Rise (m)	
		Briggs	Modified Briggs
24c*	0	94	0
25	87	93	93
26	116	93	93
27a*	99	65	47
27b*	41	54	44
28a	44	47	47
28b	6	36	36
28c*	11	39	0
29	51	47	47
30	159	83	83
31	60	74	74
32a	36	102	102
32b*	19	71	62
32c	36	59	59
33a*	136	60	34
33b	14	52	52
34	110	81	81
35	83	49	49
36*	15	62	9
37	64	50	50
38	80	105	105
39	115	84	84
40	155	124	124
41	77	45	45
42*	0	23	2
43a*	0	28	0
43b*	0	34	0
44a*	25	58	2
44b*	79	34	26
44c*	63	32	29
45a*	19	84	0
45b	35	43	43
45c*	44	30	0
46a*	33	65	0
46b	27	39	39
46c*	10	29	0
47a	69	64	64
47b	156	95	95

*Trials assumed to have downwash effects ($w/\bar{u} < 1.5$ and $Fr \geq 3.0$).

TABLE G-5

CORRELATION COEFFICIENTS AND RMS ERRORS FOR CALCULATED PLUME RISES

Data Set	Number of Trials	Correlation Coefficient	RMS Error (m)
$w/\bar{u} \geq 1.5$ and/or $Fr < 3.0$	39	0.52	39.6
$w/\bar{u} < 1.5$ and $Fr \geq 3.0$	29		
Briggs		0.05	43.7
Modified Briggs		0.42	35.7
All Trials	68		
Briggs		0.44	41.4
Modified Briggs		0.63	38.0

The analysis of the Bringfelt (1968) data described above indicates that the correction factor f should not be applied to stacks with Froude numbers less than about 3.0. However, in subsequent studies we have found some stacks with Froude numbers in the range of about 1.0 to 3.0 that appear to exhibit downwash effects when the wind speed is greater than or equal to the exit velocites. Although we have found no evidence of downwash effects for stacks with Froude numbers less than unity, we have no basis for predicting in advance whether or not the plume from a stack with a Froude number in the range 1.0 to 3.0 is subject to downwash effects.

In summary, the downwash correction factor f, which is used to modify the Briggs plume rise equations in the SHORTZ and LONGZ programs, is based on a combination of visual observations of plume behavior, the results of wind-tunnel studies reported by Briggs (1973), comparisons of concurrent calculated and observed short-term and long-term ground-level SO_2 concentrations in Lansing, Allegheny County and elsewhere, analyses of the Bringfelt (1968) plume rise data, and limited comparisons of calculated and observed plume rises for two coal-fired power plants (see Bowers and Cramer, 1976). We recognize that objections can be raised about the correction factor f because it is a semi-empirical correction that does not explicitly consider the physics of the downwash process. However, we point out that current Gaussian dispersion models are also semi-empirical. On the basis of the modeling studies performed by the H. E. Cramer Company during the last seven years, we believe that use of the correction factor f is warranted for stacks with Froude numbers greater than about 3.0. The correction factor f probably should not be used for a stack with a Froude number less than 3.0 unless observations of the plume's behavior indicate that the correction factor is applicable. (The SHORTZ or LONGZ user may delete the downwash correction for a stack by entering the stack's radius as zero.)

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APPENDIX H

DEVELOPMENT AND TESTING OF THE CRAMER, *ET AL*. (1975) COMPLEX TERRAIN DISPERSION MODELS

H.1 INTRODUCTION

One of the most important and difficult problems facing air pollution meteorologists is the prediction of the air quality impact of stack emissions in complex terrain. In the absence of detailed observations of plume behavior in complex terrain, many hypotheses about plume behavior were incorporated in short-term and long-term Gaussian dispersion models during the early 1970's. However, subsequent field experiments and monitoring programs intended to test these hypotheses (for example, Start, et al., 1974) were either inconclusive or indicated that the hypotheses were invalid. During 1974 and early 1975, we conducted a detailed study for the U. S. Environmental Protection Agency (EPA) Region III of the air quality impact of SO_2 emissions from the major stationary sources located in and adjacent to Allegheny County, Pennsylvania. On the basis of previous data from other sources located in complex terrain and a detailed examination of concurrent meteorological, emissions and air quality data for Allegheny County, we proposed a new set of procedures for calculating ground-level concentrations in complex terrain (Cramer, Geary and Bowers, 1975). The resulting short-term and long-term dispersion models yielded an excellent correspondence between calculated and observed SO_2 concentrations in Allegheny County without recourse to calibration constants that scale calculated concentrations to match observed air quality. More recent data have provided additional support for these models. This appendix discusses the development and testing of the Cramer, *et al*. (1975) terrain-adjustment procedures, which are contained in the SHORTZ and LONGZ computer programs.

H.2 MODEL CONCEPTS

The three basic concepts of the terrain-adjustment procedures used by the SHORTZ and LONGZ programs are:

1. The top of the surface mixing layer in complex terrain may be assumed to be at a constant height above mean sea level.

2. A plume must be contained within the surface mixing layer if it is to cause significant ground-level concentrations at any point, including terrain elevations that are above the top of the surface mixing layer.

3. The axis of a plume contained within the surface mixing layer remains at the plume stabilization height above mean sea level, and the plume may impact elevated terrain within the surface mixing layer under stable, neutral or unstable conditions. (The term "plume axis" as used in this appendix refers to the height of the maximum concentration within the plume after it has stabilized and before reflection from the ground surface or the top of the surface mixing layer affects the height of the maximum concentration.)

The first model concept is principally based on our observations of the behavior of highly-visible plumes from the 122-meter stacks of a copper smelter located at the northern end of the Oquirrh Mountains in Utah. (The 122-meter stacks have been replaced by a new 380-meter stack.) During periods when the top of the surface mixing layer was below the ridge-line, the smelter's emissions were trapped within the mixing layer and did not affect the terrain above the top of the surface mixing layer. Start, et al. (1976) also found the top of the mixing layer to be at a constant height above mean sea level during periods when the top of the mixing layer was above the ridgeline. Observations of visible air pollutants in areas such as the Los Angeles basin provide additional support for the first model concept.

The second model concept is based on both empirical and theoretical evidence. For example, during the well-known Trail, British Columbia study (Hewson and Gill, 1944), high SO_2 concentrations were measured in a stable layer above the valley floor, but only low concentrations were measured at the valley sides. Similarly, a numerical model developed by Roffman and Grimble (1974) yields calculated concentrations at the surface for plumes passing over elevated terrain under neutral or unstable conditions that are 10^5 times higher than the concentrations calculated at the surface under stable conditions, indicating that a plume contained in an elevated stable layer does no significantly affect ground-level concentrations.

The third model concept, which is empirical, evolved during the Allegheny County SO_2 study. Most complex terrain dispersion models in existence in 1974 assumed that terrain effects were important only under stable conditions. Start, et al. (1974) had reported plume impaction on elevated terrain under neutral and unstable conditions, but the impactions were reported as being transient. However, visual observations of the plumes from the West Penn Power Plant in the Springdale-Logans Ferry area of Allegheny County indicated that the plumes directly impacted the hill on which the monitor is located during periods of moderate-to-strong west-southwest winds. The only additional major SO_2 source upwind from the Logans Ferry monitor during periods of west-southwest winds was the Cheswick Power Plant. Thus, the combination of visual observations of the behavior of the West Penn Plant's plumes, the observed air quality data and the relative isolation with west-southwest winds of the Logans Ferry monitor from SO_2 sources other than the two power plants resulted in ideal conditions for model testing. The 3-hour and 24-hour average SO_2 concentrations calculated for the air pollution episode at Logans Ferry on 4 January 1973 were far below the observed concentrations unless it was assumed the plumes directly impacted the hill. Consequently, the third model concept was incorporated in the SHORTZ and LONGZ programs for use in the Allegheny County SO_2 study. The results of the historical calculations for Allegheny County are given in Section H.3. The 4 January 1973 air pollution episode at Logans Ferry is also the SHORTZ example problem discussed in Section 2.6 and Appendix C.

H.3 MODEL TESTING

The terrain-adjustment procedures contained in the SHORTZ and LONGZ programs have been tested as part of a number of air quality modeling studies during the last seven years. In many cases, the detailed emissions, meteorological and air quality data required for quantitative model testing were not available. However, the results of the model calculations for these cases were consistent with observed air quality and tended qualitatively to confirm the basic modeling approach. In several other studies, concurrent emissions, meteorological and air quality data were available for detailed model testing. These studies include the Allegheny County SO_2 study (Cramer, et al., 1975 and Cramer, et al., 1976b), the ASARCO-Tacoma copper smelter study (Cramer, et al., 1976a; Cramer, et al., 1977 and Wilson, et al., 1977), the West Virginia power plant study (Cramer and Bowers, 1976 and Bowers and Cramer, 1976) and the Port Angeles, Washington SO_2 study (Bowers, et al., 1980). Additionally, the SHORTZ program was used with historical meteorological data to predict the magnitude and location of the maximum 24-hour average SO_2 concentration attributable to emissions from the West Penn Power Company Mitchell Power Plant as well as the meteorological conditions causing this maximum concentration (U. S. versus West Penn Power, 1978). Each of these studies is briefly discussed in the following paragraphs. We point out that the question of what specific measures of performance should be applied in testing atmospheric dispersion models is a current major topic of discussion (for example, Fox, 1981). The measures of performance used in the following paragraphs are the measures that were used in the original reports and papers which presented the results of the various studies.

Allegheny County SO_2 Study (Cramer, et al., 1975)

Table H-1 summarizes the results of our dispersion model calculations of short-term average ground-level SO_2 concentrations produced by 107 major sources and source complexes located in and adjacent to Allegheny County, Pennsylvania. The concentrations in Table H-1 were calculated directly from concurrent emissions and meteorological data and were not adjusted by means of any calibration constants that scale the model concentrations to match observed air quality. (The 3-hour and 24-hour average concentrations were calculated by SHORTZ, while the annual average concentrations were calculated by LONGZ.) On the average, the calculated maximum 3-hour concentrations are about 14 percent higher than the observed concentrations, the 24-hour average concentrations are 83 percent of the observed concentrations and the annual average concentrations are 92 percent of the observed concentrations. Finkelstein (1976) also compared the results of the short-term model calculations with the results of wind-tunnel simulations of various sources in the Clairton area of Allegheny County and concluded that "the agreement between the two studies is surprisingly and reassurringly close."

ASARCO-Tacoma Smelter Study (Cramer, et al., 1976a)

Our study for EPA of the air quality impact of SO_2 emissions from the ASARCO-Tacoma copper smelter (Cramer, Bowers and Geary, 1976a) also provided insight into plume behavior in complex terrain. Although the minimum stack height to terrain height ratio for the locations of the air quality monitors is 1.7, failure to include terrain adjustments in the model calculations would have caused significant underpredictions of the observed SO_2 concentrations in the Tacoma area. The SO_2 monitoring networks operated by the ASARCO smelter and the Puget Sound Air Pollution Control Agency (PSAPCA) are sufficiently dense that the ASARCO plume was simultaneously detected by two or more SO_2 monitors during a number of cases that we studied.

TABLE H-1

COMPARISON OF CALCULATED AND OBSERVED 1973 GROUND-LEVEL SO_2 CONCENTRATIONS IN ALLEGHENY COUNTY*

Case	Monitor Location	SO_2 Concentrations ($\mu g/m^3$)		$\frac{\text{Calculated Concentration}}{\text{Observed Concentration}}$
		Calculated	Observed	
(a) 3-Hour Maximum Concentration				
4 January 1973	Logans Ferry	2,207	1,880	1.17
18 January 1973	Glassport	375	300	1.25
18 January 1973	Liberty Borough	717	1,305	0.55
13 July 1973	Glassport	496	395	1.26
13 July 1973	Liberty Borough	1,204	820	1.47
			Mean Ratio	1.14
(b) 24-Hour Average Concentration				
4 January 1973	Logans Ferry	979	891	1.10
18 January 1973	Glassport	186	153	1.22
18 January 1973	Liberty Borough	268	647	0.41
13 July 1973	Glassport	101	139	0.73
13 July 1973	Liberty Borough	258	361	0.71
			Mean Ratio	0.83
(c) Annual Average Concentration				
1973	Glassport	80	79	1.01
1973	Liberty Borough	116	139	0.83
1973	Hazelwood	86	92	0.93
			Mean Ratio	0.92

*Based on data given by Cramer, Geary and Bowers (1975).

For these cases, it was possible to refine the observed surface wind direction and to accurately position the plume with respect to the monitoring network in the SHORTZ calculations. Table H-2 shows a comparison of calculated and observed hourly SO_2 concentrations for the cases when the observed concentrations exceeded the PSAPCA hourly ambient air quality standard of 0.25 parts per million (ppm). The average of the ratios of individual calculated and observed concentrations is unity which indicates that the model calculations do not contain any systematic errors. Differences between individual calculated and observed concentrations were found to be principally explained by random errors in the meteorological and source inputs as well as by uncertainties in the air quality data (see Cramer, et al., 1977). For example, the smelter uses a Supplementary Control System (SCS) that reduces SO_2 emissions by as much as a factor of ten when high ground-level concentrations are anticipated or observed. It was therefore frequently difficult to obtain accurate estimates of the effective hourly emission rates.

Comparisons of calculated and observed annual average ground-level SO_2 concentrations were complicated in the ASARCO-Tacoma smelter study because all of the observed concentrations are below the threshold and accuracy of the monitors of about 0.01 ppm. However, with one exception, all of the annual SO_2 concentrations calculated by LONGZ for 1972 are within the range of error assigned to the observed concentrations (plus or minus one-half the accuracy and threshold of the monitors). The single exception is the smelter's monitor at N. 26th and Pearl where the observed annual concentration is more than three times larger than the annual concentration measured by the PSAPCA monitor also located at N. 26th and Pearl (see Wilson, et al., 1977).

West Virginia Power Plant Study (Cramer and Bowers, 1976a)

The Kammer and Mitchell Power Plants are located on the east side of the Ohio River Valley in Marshall County, West Virginia. The valley width varies from 1 to 2 kilometers, and terrain elevations on both sides of the

TABLE H-2

COMPARISON OF CALCULATED AND OBSERVED SO_2 CONCENTRATIONS FOR CASES WHEN THE OBSERVED HOURLY CONCENTRATION EXCEEDED 0.25 PPM (FROM CRAMER, ET AL., 1976a)

Case No.	Monitor	Observed Concentration* (ppm)	Calculated Concentration (ppm)	Ratio of Calculated and Observed Concentrations**
2	N26th and Pearl	(1.23)	0.88	(0.72)
	Reservoir	0.27	0.04	0.15
	Highlands	0.73	0.44	0.60
3	N26th and Pearl	0.40 (0.46)	0.25	0.63 (0.54)
4	N26th and Pearl	0.56 (0.68)	0.61	1.09 (0.90)
	Reservoir	0.62	0.64	1.03
6	N26th and Pearl	0.30 (0.22)	0.30	1.00 (1.36)
	N26th and Pearl	0.26 (0.26)	0.23	0.88 (0.88)
7	N26th and Pearl	0.60 (0.46)	0.26	0.43 (0.57)
8	N26th and Pearl	0.32 (0.21)	0.44	1.38 (2.10)
	Reservoir	0.37	0.39	1.05
9	N26th and Pearl	0.37 (0.67)	0.64	1.73 (0.96)
	N26th and Pearl	0.31 (0.21)	0.11	0.35 (0.52)
10	N26th and Pearl	0.25 (0.25)	0.34	1.36 (1.36)
12	McMicken Heights	0.50	0.52	1.04
13	Meeker	0.28	0.28	1.00
	Meeker-Brown	0.31	0.35	1.13
	Meeker	0.38	0.42	1.11
	Meeker-Brown	0.42	0.50	1.19
	Meeker	0.59	0.56	0.95
	Meeker-Brown	0.49	0.53	1.08
14	McMicken Heights	0.30	0.09	0.33
	Tukwila	0.41	0.10	0.24
19	N26th and Pearl	0.42 (0.35)	0.87	2.07 (2.49)
	Reservoir	0.50	1.00	2.00
	N26th and Pearl	0.27 (0.17)	0.10	0.37 (0.59)
			Mean Ratio	0.97 (1.00)

*Numbers enclosed by parentheses are concentrations measured by the ASARCO SO_2 monitor at N26th and Pearl.

**Numbers enclosed by parentheses are the ratios of calculated and observed concentrations for the ASARCO monitor at N26th and Pearl.

river range from 100 to 200 meters above the valley floor. The Mitchell Power Plant has a single 365-meter stack that is one of the tallest in the United States. The Kammer Power Plant has two 183-meter stacks that extend to about the same height as the terrain on either side of the river valley. The heat content of the Kammer No. 1 stack is about double that of the Kammer No. 2 stack. During the period August-September 1975, the EPA Environmental Monitoring and Support Laboratory (Las Vegas, Nevada) made airborne measurements of SO_2 concentrations downwind from the two power plants. We used concurrent meteorological and emissions data with our short-term dispersion model, modified to contain the generalized form of the Vertical Term (i.e., modified to enable concentration calculations at points above the surface), to calculate the plume characteristics for comparison with the EMSL measurements. The following discussion is principally taken from a paper by Bowers and Cramer (1976).

The observed plume rise for each stack was determined for each trial by subtracting the stack height from the height of the corresponding maximum observed SO_2 concentration at the closest downwind distance at which aircraft measurements were made. This measurement distance was always greater than the calculated plume stabilization distance and was also frequently at a distance where the plume from the Kammer No. 2 stack was significantly affected by reflection from the ground. In these cases, the height of the maximum observed SO_2 concentration for the Kammer No. 2 plume should be lower than the plume stabilization height because reflection from the ground decreases the height of the maximum concentration and eventually brings it to the ground surface. Reflection from the bases of elevated inversions at the top of the surface mixing layer also affected the observed SO_2 concentrations in some of the trials, but this effect was generally small in comparison with the effect of ground reflection. Interaction of the Kammer No. 1 and No. 2 plumes additionally affected the observed maximum concentrations and introduced other uncertainties in the determination of the observed plume rises from the aircraft measurements.

Table H-3 shows the observed plume rises determined from the aircraft measurements and the corresponding calculated plume rises. For the reasons given above, we believe that the observed plume rises for the Kammer No. 2 stack generally underestimate the actual plume rises and have indicated this qualification by quotation marks. In Trials 10 and 11, the heat contents and SO_2 emissions for both Kammer plumes were nearly identical and the aircraft observations for each trial showed a single merged plume. The predicted plume rises in Table H-3 are in good agreement with the observations for Mitchell and Kammer No. 1. In every case, the plume rise calculated for Kammer No. 2 exceeds the "observed" plume rise. As explained above, this result was expected because of the interaction of this plume with the terrain at the distance of the aircraft measurements.

Table H-4 presents the calculated and observed axial SO_2 concentrations. Heights 1 and 2 in the table are the heights of the two highest measured concentrations and refer either to the two Kammer plumes individually, or to a single merged Kammer plume and the Mitchell plume. Downwind Distance 1 in the table varies from about 3.7 to 11 kilometers and Downwind Distance 2 varies from about 7.4 to 18.5 kilometers. As discussed above, the heights of the two highest observed concentrations do not necessarily correspond to the actual plume stabilization heights because of the effects of reflection and interaction of superposed plumes. The calculated axial concentrations are the concentrations calculated by means of the short-term dispersion model equations at the heights of the highest concentrations measured by EMSL, using the Briggs plume rise formulas in Section 2.2 to obtain plume stabilization heights. The calculated axial concentrations thus include the effects of reflection and the combined contributions of the two Kammer plumes plus, where appropriate, the contribution of the Mitchell plume.

Table H-4 shows that the model estimates of axial concentrations are, on the average, approximately 21 percent larger than the observed axial concentrations at Downwind Distance 1. This could be due to the fact that the observed concentrations have not been adequately adjusted for the response time of the SO_2 instrument in the helicopter. Also, the Mitchell plume

TABLE H-3

CALCULATED AND OBSERVED PLUME RISES FOR THE MITCHELL AND KAMMER POWER PLANTS (FROM BOWERS AND CRAMER, 1976)

Trial Number	Mitchell Plume Rise (m)			Kammer No. 1 Plume Rise (m)			Kammer No. 2 Plume Rise (m)		
	O	C	C/O	O	C	C/O	"O"	C	C/"O"
1	186	176	0.95	-	-	-	-	-	-
3	338	270	0.80	412	486	1.18	230	391	1.70
5	-	-	-	839	602	0.72	382	478	1.25
6	-	-	-	291	262	0.90	-	-	-
7	-	-	-	412	420	1.02	230	319	1.39
8	369	347	-.94	534	668	1.25	458	534	1.17
10	-	-	-	321	324	1.01	321	337	1.05
11	348	345	0.99	412	413	1.00	412	427	1.04
12	217	253	1.17	351	386	1.10	-	-	-
13	308	308	1.00	229	245	1.07	-	-	-
15	400	401	1.00	473	316	0.67	229	241	1.05
16	140	200	1.43	214	172	0.80	-	-	-
	Mean Ratio		1.04	Mean Ratio		0.97	Mean Ratio		1.24

O = Observed Plume Rise

C = Calculated Plume Rise

O/C = Ratio of Calculated and Observed Plume Rise

TABLE H-4

CALCULATED AND OBSERVED AXIAL SO_2 CONCENTRATIONS
(FROM BOWERS AND CRAMER, 1976)

Trial	Axial SO_2 Concentration (ppm)											
	Downwind Distance 1						Downwind Distance 2					
	Height 1			Height 2			Height 1			Height 2		
	O	C	C/O	O	C	C/O	O	C	C/O	O	C	C/O
3	0.71	0.67	0.94	0.68	0.75	1.10	0.26	0.17	0.65	0.28	0.17	0.61
5	0.25	0.33	1.32	-	-	-	-	-	-	-	-	-
6	0.99	1.48	1.49	-	-	-	0.60	0.52	0.87	-	-	-
7	0.51	0.53	1.04	-	-	-	-	-	-	-	-	-
12	0.50	0.62	1.24	1.17	1.47	1.26	-	-	-	-	-	-
13	1.86	2.35	1.26	-	-	-	0.87	0.65	0.75	1.15	0.69	0.60
	Mean Ratio		1.22	Mean Ratio		1.18	Mean Ratio		0.75	Mean Ratio		0.61

O = Observed Concentration

C = Calculated Concentration

O/C = Ratio of Calculated and Observed Concentration bifurcated during several trials, and the model would be expected to overpredict axial concentrations within several kilometers of the stack under these conditions. At Downwind Distance 2, the calculated axial concentrations are all less than the observed concentrations. The fact that no SO_2 background is included in the calculated values partially accounts for this result. However, because the lateral diffusion coefficient α in Equation (2-18) was set equal to 1.0 rather than to 0.9, it is also possible that lateral plume spread was overestimated at Downwind Distance 2.

Two trials of particular interest were the two trials when the Kammer plumes were observed to be impacting on nearby elevated terrain. On both occasions, the EMSL helicopter made a number of passes through the plumes at a height of 15 to 30 meters above ground level. Table H-5 lists the observed maximum SO_2 concentrations and the maximum 10-minute ground-level SO_2 concentrations calculated with and without the terrain-adjustment procedures contained in the SHORTZ and LONGZ programs. If it is assumed that the plume axes are terrain following under neutral or unstable conditions (i.e., no terrain adjustments are required), the calculated concentrations are substantially lower than the observed concentrations. However, the 10-minute concentrations calculated by including terrain effects are in good agreement with the observed concentrations.

The Port Angeles, Washington SO_2 Study

The major SO_2 sources in the Port Angeles, Washington area are the Crown Zellerbach and ITT Rayonier Pulp Mills, both of which are located along the shoreline of Port Angeles Harbor. In general, the terrain in the Port Angeles area rises abruptly near the shoreline from sea level to about 50 meters above mean sea level (MSL). The highest observed SO_2 concentrations in the area occur east-southeast of the ITT Mill at the Third & Chestnut and Fourth & Baker monitoring sites. The Third & Chestnut site is about 800 meters from the center of the ITT Mill, while the Fourth & Baker site is about 1,200 meters from the center of the mill. The terrain elevations

TABLE H-5

MAXIMUM OBSERVED AND CALCULATED GROUND-LEVEL SO_2 CONCENTRATIONS
(FROM BOWERS AND CRAMER, 1976)

Trial (Pasquill Stability Category)	Terrain Height (m above MSL)	Observed Conc. (ppm)	Calculated Concentration (ppm)		$\frac{\text{Calculated Concentration}}{\text{Observed Concentration}}$	
			With terrain adjustments	Without terrain adjustments	With terrain adjustments	Without terrain adjustments
3 (B)	442	0.52	0.76	0.35	1.46	0.67
17 (D)	274	0.15	0.14	0.02	0.93	0.13
				Mean Ratio	1.20	0.40

at the two monitoring sites are greater than or approximately equal to the stack-top elevations of all of the SO_2 sources except for a relatively minor SO_2 source at the ITT Mill. The principal source of the meteorological inputs used in our dispersion model calculations was a 10-meter tower located on the tip of Ediz Hook, a spit that protrudes into the Strait of Juan de Fuca and forms Port Angeles Harbor. The location of the 10-meter tower is about 2.5 kilometers north of the ITT Mill. We selected 20 hours for model testing using the following criteria:

- An observed 1-hour SO_2 concentration at one of the two monitors greater than or equal to 0.20 ppm and a concurrent observed concentration at the second monitor greater than or equal to 0.05 ppm

- Availability of complete meteorological data for the Ediz Hook tower

- Operation of a minimum of three of the six ITT SO_2 sources for which emissions data were available

We added the third selection criterion because all of the ITT SO_2 sources were to be considered in our analysis of the attainment status of the existing sources with the National Ambient Air Quality Standards (NAAQS) and we wished to test the performance of SHORTZ under conditions approximating the operating conditions for the attainment status calculations.

After the selection of the 20 hours for model testing, we learned from the Washington Department of Ecology (DOE) that the black liquor holding pond at the ITT Mill is a continuous and highly variable source of SO_2 emissions that can have a significant impact on ambient air quality. The wind directions required for the straight-line transport of the stack emissions from the ITT Mill to Fourth & Baker are identical to the directions required for the straight-line transport of emissions from the holding pond to Fourth & Baker. However, it is possible for emissions from the ITT stacks to be directly transported to Third & Chestnut without the emissions from the holding pond having any significant effect on ambient air quality at Third & Chestnut. Our inspection of the Ediz Hook wind directions during the hours selected for model testing indicated that the concentrations measured at Third & Chestnut during these hours probably were almost entirely determined by emissions from the ITT stacks, while the concurrent concentrations at Fourth & Baker were determined by the combined emissions from the ITT stacks and the holding pond. Because the emissions from the holding pond were unquantified, we used the centerline concentrations calculated by SHORTZ at the Third & Chestnut monitor to test the model's performance. That is, we assumed that the wind transported the merged ITT plume in a straight line to the Third & Chestnut monitor during each of the 20 hours. Assuming a "perfect model" and representative model inputs as well as air quality observations, the calculated centerline concentrations at Third & Chestnut should be greater than or equal to the corresponding observed concentrations for every hour. Also, as shown below, the ratio of the average centerline concentration calculated at Third & Chestnut to the average observed concentration should be about 1.75.

The neutral Pasquill D stability category existed during 19 of the hours selected for model testing, while the slightly unstable C category existed during the remaining hour. Additionally, moderate or strong wind speeds occurred during all of the hours. Thus, the general meteorological conditions during all of the hours selected for model testing were very similar. Consequently, the lateral dispersion coefficient σ_y of the merged ITT plume at Third & Chestnut should have been about the same during each of the hours. Because of the occurrence of relatively high hourly SO_2 concentrations at Third & Chestnut during the 20 hours, we assumed that the monitor was within $\pm 2.15\ \sigma_y$ of the plume centerline during each hour.

The Mean Ratio (MR) of calculated centerline to observed concentrations is defined as

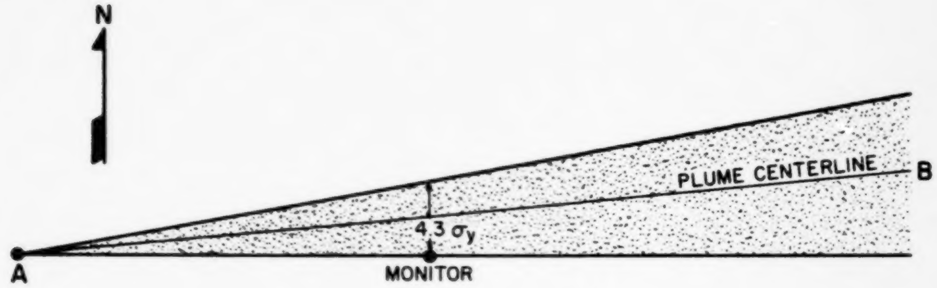
$$MR = \left[\frac{\sum_{i=1}^{N} \chi_{cc_i}}{N}\right]\left[\frac{\sum_{i=1}^{N} \chi_{oi}}{N}\right]^{-1}$$

$$= \left[\bar{\chi}_{cc}\right]\left[\bar{\chi}_{o}\right]^{-1} \tag{H-1}$$

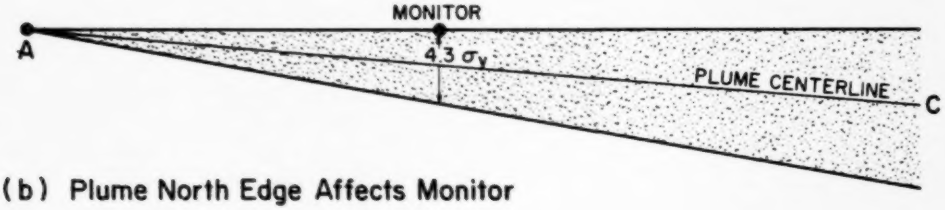
where χ_{cc_i} is the i^{th} calculated centerline concentration and χ_{oi} is the i^{th} observed concentration. As illustrated by Figure H-1, the width of the wind-direction sector required for the Third & Chestnut monitor to be within ±2.15 σ_y of the centerline of the merged plume from the ITT Mill is 4.3 σ_y. If it is assumed that all wind directions within this sector are equally probable, the sum of a large sample of the hourly concentrations produced by the ITT plume at Third & Chestnut, divided by the number of observations, yields a sector-averaged concentration. If a Gaussian plume is averaged over the sector ±2.15 σ_y, the ratio of the sector-averaged concentration $\bar{\chi}$ to the centerline concentration χ_c is given by

$$\frac{\bar{\chi}}{\chi_c} = \frac{1}{4.3\,\sigma_y}\int_{-2.15\,\sigma_y}^{2.15\,\sigma_y} \exp\left[-\frac{1}{2}\left(\frac{y'}{\sigma_y}\right)^2\right] dy'$$

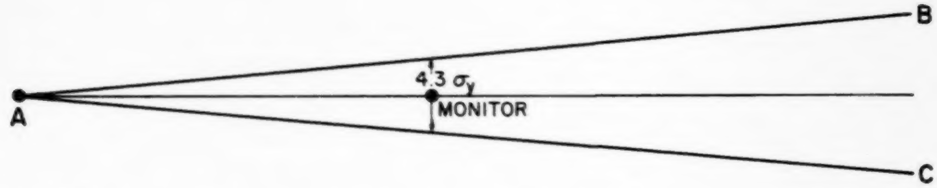
$$= \frac{\sqrt{2\pi}}{4.3}\ \mathrm{erf}\left(\frac{2.15}{\sqrt{2}}\right) = 0.57 \tag{H-2}$$



(a) Plume South Edge Affects Monitor



(b) Plume North Edge Affects Monitor



(c) Wind-Direction Sector for Plume Affecting Monitor

FIGURE H-1. Schematic illustration that the width of the sector of wind directions required for a plume to affect the concentration at a monitor is equal to the plume width (4.3 σ_y) at the monitor.

Thus, $\bar{\chi}_o$ in Equation (H-1) is approximately given by

$$\bar{\chi}_o = 0.57 \, \bar{\chi}_{oc} \qquad \text{(H-3)}$$

where $\bar{\chi}_{oc}$ is the average of the actual centerline concentrations at the distance and elevation of Third & Chestnut. It follows from Equations (H-1) and H-3) that the expected value of the MR is

$$MR = \left[\bar{\chi}_{cc}\right]\left[0.57 \, \bar{\chi}_{oc}\right]^{-1} = 1.75 \, \bar{\chi}_{cc}/\bar{\chi}_{oc} \qquad \text{(H-4)}$$

In the absence of any systematic errors in the model, the model inputs or the observed concentrations, the ratio χ_{cc}/χ_{oc} should be unity, leading to an expected MR of about 1.75.

Table H-6 compares the calculated centerline and corresponding observed hourly SO_2 concentrations at the Third & Chestnut monitor for the 20 hours. The calculated concentrations include background concentrations estimated from the concurrent hourly concentrations measured at the Olympic National Park Visitors Center, an inland site unlikely to be directly affected by emissions from the two pulp mills during periods when emissions from the ITT Mill cause relatively high concentrations at Third & Chestnut. (The background concentration for Case 3 is 0.01 ppm, the background concentration for Case 14 is 0.03 ppm and the background concentration for each of the remaining cases is zero.) With the exception of Cases 10, 11 and 15, all of the calculated centerline concentrations are greater than or equal to the corresponding observed concentrations. The underpredictions for these three cases are small if allowance is made for the uncertainties in the model inputs. For example, the actual SO_2 emission rates may have been higher than the emission rates assumed in the model calculations because the pollution control system used by the ITT Mill during the hours selected for model testing was not very reliable. The MR of 1.85 is in close agreement with the expected value of 1.75 and indicates that, on the average, the model is accurate to within about 10 percent.

TABLE H-6

COMPARISON OF CALCULATED CENTERLINE AND CORRESPONDING OBSERVED 1-HOUR SO_2 CONCENTRATION AT THIRD & CHESTNUT (FROM BOWERS, ET AL., 1980)

Case	Concentration (ppm)		Ratio of Calculated and Observed Concentrations
	Observed	Calculated Centerline*	
1	0.11	0.32	2.91
2	0.27	0.32	1.19
3	0.23	0.30	1.30
4	0.13	0.22	1.69
5	0.13	0.18	1.38
6	0.09	0.35	3.89
7	0.08	0.37	4.63
8	0.07	0.37	5.29
9	0.13	0.56	4.31
10	0.33	0.23	0.70
11	0.19	0.17	0.89
12	0.20	0.36	1.80
13	0.19	0.43	2.26
14	0.30	0.30	1.00
15	0.47	0.44	0.94
16	0.17	0.37	2.18
17	0.12	0.37	3.08
18	0.06	0.36	6.00
19	0.15	0.32	2.13
20	0.13	0.24	1.85
		Mean Ratio (MR)	1.85

*The calculated concentrations include background (the concurrent SO_2 concentrations measured at the Visitor Center).

The Mitchell Power Plant Study (U. S. versus West Penn Power Company)

The four modeling studies described above involved the use of historical emissions, meteorological and air quality data to test the terrain-adjustment procedures contained in the SHORTZ and LONGZ programs. However, there is one case in which the SHORTZ program was used with historical meteorological data to predict in advance the magnitude and location of the maximum 24-hour average SO_2 concentration. The Mitchell Power Plant of West Penn Power Company is located on the west bank of the Monongahela River, south of Allegheny County, Pennsylvania. Terrain elevations on either side of the river equal or exceed the heights of the Mitchell stacks. In support of the Pennsylvania Department of Environmental Resources (DER) and EPA Region III, we used 1964 surface and upper-air meteorological data from the Greater Pittsburgh Airport to predict the magnitude and location of the maximum 24-hour average ground-level SO_2 concentration attributable to Mitchell emissions. According to the results of our calculations, a maximum 24-hour average concentration of about 2,100 micrograms per cubic meter should occur on a hill about 1 kilometer east-northeast of the plant during periods of persistent moderate-to-strong west-southwest winds in combination with neutral stability. On the basis of the results of our calculations, the Pennsylvania DER placed one SO_2 monitor on the hill east-northeast of the plant, which is at about the same elevation as the tops of the Mitchell stacks, and one monitor upwind (west) of the plant during periods of west-southwest winds.

The Pennsylvania DER SO_2 monitoring program covered the approximate period October 1976 through January 1977. Considering the short period of record and the amount of missing data, a large number of violations of the 24-hour NAAQS of 365 micrograms per cubic meter were observed during this period. The maximum observed 24-hour average SO_2 concentration of about 1,800 micrograms per cubic meter occurred on 1 January 1977. Although this measured 24-hour average concentration is only about 86 percent of the predicted maximum concentration, the actual 24-hour average concentration exceeded 1,800 micrograms per cubic meter because the hourly SO_2 concentrations exceeded the monitor full-scale setting of about 2,500 micrograms per cubic meter for three consecutive hours on 1 January 1977. The hourly SO_2 concentrations measured at the upwind monitor were all below the monitor threshold of about 25 micrograms per cubic meter on 1 January 1977, a day of persistent moderate-to-strong west-southwest winds. The close correspondence between predicted and observed 24-hour average SO_2 concentrations was cited by the U. S. District Court for the Western District of Pennsylvania (1978) as one of the factors supporting the Court's ruling against West Penn Power Company. A discussion of the legal aspects of this case is given by Morse (1979).

H.4 SUMMARY

The complex terrain dispersion models first suggested by Cramer, et al. (1975) and implemented by the SHORTZ and LONGZ computer programs represent a very simple approximation of complex plume-terrain interactions. Although objections can be raised about some or all of the model assumptions, our testing of the models in a wide variety of situations indicates that the combination of the various model assumptions yields calculated ground-level concentrations that are in accord with the available air quality data without recourse to calibration constants. We recognize that our models may not be applicable to all situations. However, we have found no inconsistencies between the data available to us and our basic model concepts.

The Cramer, et al. (1975) complex terrain dispersion models are occasionally identified by courts, consulting firms and regulatory agencies as the "Cramer Model." We point out that the "Cramer Model" includes our dispersion coefficients, our versions of the Briggs plume rise equations, the terrain-adjustment procedures discussed in this appendix, and the general modeling approach (including the Turner (1964) stability classification scheme in the absence of direct turbulence measurements) outlined in Section 2. We do not consider any model that does not contain all of the components of the Cramer, et al. (1975) models to be representative of the "Cramer Model." For example, a model that uses our dispersion coefficients and terrain-adjustment procedures, but does not use our plume rise equations or the Turner (1964) stability classification scheme, should not be considered to be representative of the "Cramer Model." Similarly, the use of SHORTZ with mixing depths that are not consistent with the concept of the mixing depth defined in Section 2.1.1 is an erroneous application and should not be considered to be representative of the "Cramer Model."

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APPENDIX I.

THE SHORTZ METEOROLOGICAL PREPROCESSOR PROGRAM

I.1 DESCRIPTION OF THE SHORTZ PREPROCESSOR PROGRAM METZ

The METZ meteorological preprocessor program is designed to use National Weather Service (NWS) hourly surface weather observations and twice-daily mixing height estimates to generate a magnetic tape of the hourly values of the meteorological input parameters required by the SHORTZ program. The inputs required by METZ are: (1) hourly NWS observations of surface wind speed, wind direction, cloud cover and ceiling height in magnetic tape format; and (2) daily minimum and maximum mixing heights in punched card format, as determined from NWS 1200 GMT upper-air temperature soundings using the methods of Holzworth (1972). With the exception of program control parameters, the METZ input requirements and formats are the same as for the meteorological preprocessor program for the U. S. Environmental Protection Agency's short-term dispersion models such as the Single Source (CRSTER) Model (EPA, 1977).

METZ converts the NWS surface wind speeds from knots to meters per second. If the wind speed is calm or less than 1.0 meter per second, the wind speed is set equal to 1.0 meter per second. The NWS surface wind directions, which are reported to the nearest 10-degree sector, are randomized to the nearest degree within the sector in an attempt to account for the actual variability of the wind within the sector. The METZ randomization procedure differs from that used by the EPA meteorological preprocessor program in two ways. First, METZ does not convert the observed wind directions to directions toward which the wind is blowing because SHORTZ is designed to use conventional wind directions (directions from which the wind is blowing). Second, the random number generator used by METZ is the H. E. Cramer Company's UNRAN subroutine rather than the UNIVAC system RANDU subroutine. If the wind is calm, the wind direction before randomization is set equal to the wind direction during the last non-calm hour. (Hours of calm winds are flagged in the METZ listings of hourly meteorological inputs.) METZ converts the surface temperature from degrees Fahrenheit to degrees Kelvin for use in the SHORTZ calculations. Urban or rural mixing depths are interpolated following the procedures discussed in Secton 2.1.1 (see Figure 2-1). The Turner (1964) approach is used to calculate the Pasquill stability category during each hour. As a user option, METZ will not allow the stability to change by more than one category from one hour to the next. Wind-profile exponents are automatically assigned by SHORTZ on the basis of wind speed and stability (see Table 2-2 in Section 2.1.1), while the lateral and vertical turbulent intensities are automatically assigned on the basis of stability (see Table 2-3 in Section 2.1.1). SHORTZ program control parameter ISW(17) determines whether urban or rural turbulent intensities are used in the model calculations (see Section 3.1.2). METZ assigns the vertical potential temperature gradients listed in Table 2-4 in Section 2.1.1 on the basis of stability and wind speed; the user must specify whether the values for humid or arid regions are to be used.

It is important to note that concentrations calculated using Gaussian dispersion models such as SHORTZ are inversely proportional to the mean wind speed. Thus, the calculated concentrations approach infinity as the mean wind speed approaches zero (calm). Also, NWS surface wind speeds and wind directions are short-term averages that often will not be representative of hourly average wind speeds and wind directions under light wind conditions. The procedures used by METZ to account for hours with light or calm winds are based on the arbitrary procedures used by the EPA meteorological preprocessor program. It has been the experience of the H. E. Cramer Company that the hourly concentration patterns calculated by SHORTZ during hours with NWS surface wind speeds less than about 3 knots (1.54 meters per second) are often unreliable because of the deficiencies for modeling purposes of the NWS surface wind data. The user is therefore strongly urged to examine the meteorological conditions associated with the highest calculated short-term concentrations. If hours with wind speeds less than about 1.5 meters per second account for the highest calculated short-term concentrations, the accuracy of these calculated concentrations may be questionable.

I.2 DATA INPUT DESCRIPTION

This section describes all card and tape input required by the SHORTZ preprocessor program METZ.

I.2.1 Program Control Parameter Data

These card input data contain parameters which provide user control of all program options and user input constants.

Parameter Name	Description
ITITLE	Heading Label - This parameter allows the user to enter up to 80 characters of run identification information. The information entered in this parameter is printed at the top of each page of print output.
ISW(1)	Stability Option - This option allows the user to specify one of two Pasquill stability category output modes. A value of "0" or blank directs the program to output the actual Pasquill stability category computed for each hour regardless of the stability during the previous hour. A value of "1" directs the program to output a modified Pasquill stability category that does not vary by more than one category from one hour to the next.
ISW(2)	Potential Temperature Gradient (DLTH/DZ) Option - This option allows the user to use vertical potential temperature gradients for either humid or arid regions. The values

	assigned on the basis of wind speed and stability are listed in Table 2.4 in Section 2.1.1. A value of "0" or blank directs the program to use humid values. A value of "1" directs the program to use arid values.
ISW(3)	Mixing Depth Option - This option allows the user to compute either rural or urban mixing depths. The procedure used to determine mixing depths is described in Section 2.1.1. A value of "0" or blank directs the program to compute rural mixing depths. A value of "1" directs the program to compute urban mixing depths.
ISW(4)	Day Option - This option allows the user to process selected days of the year. If ISW(4) equals "0" or blank, SHORTZ hourly meteorological inputs will be output for all 365 or 366 days of the year. A value of "1" for ISW(4) directs the program to read the IDAYS array from input cards 4 through 8 and to output SHORTZ hourly meteorological inputs only for the days with the corresponding value of IDAYS set equal to "1".
ISW(5)	Punch Option - This option allows the user to output the SHORTZ hourly meteorological inputs to either punched cards or a disk file. If ISW(5) equals "0" or blank, the output is punched on cards. If ISW(5) equals "1", the output is written to a disk file referenced by unit number 9.
IST	The NWS surface station WBAN number. The station number read from the CD 144 surface data input from unit number 8 is checked against IST to insure that correct data are used.
IYR	Year of surface data. IYR is used to check the CD 144 surface data.

ALAT	Latitude of surface station.
ALONG	Longitude of surface station.
ZONE	The time zone in which the surface station is located. For the continental United States time zones, inputs are: Eastern=5, Central=6, Mountain=7, Pacific=8.
A	Lateral diffusion coefficient. The default value equals 0.90.
CON	Rural mixing depth constant. The default value equals 100.0. CON is multiplied by average wind speed to calculate rural nighttime mixing depths.
IDAYS	Select Day Indicator - This parameter is omitted if ISW(4) equals "0" or blank. The variable IDAYS, a 366-word array, directs the METZ program to process a user-specified subset of days from the full year of surface and upper-air input data. If an array element of IDAYS has a value of "0", the corresponding Julian Day of data is skipped and SHORTZ hourly meteorological inputs are not output for that Julian Day. If the array element of IDAYS has a value of "1", the corresponding Julian Day of data is processed and SHORTZ hourly meteorological inputs are output to either punched cards or a disk file. For example, if IDAYS(165) equals "1", SHORTZ meteorological inputs are output for each hour of Julian Day 165.

I.2.2 Surface Data

METZ requires hourly NWS surface weather observations. Magnetic tapes containing the hourly surface data in "Card Deck 144 (CD 144) format" are available from the National Climatic Center (NCC) in Asheville, North

Carolina. The format of these tapes is described in the Card Deck 144 WBAN Hourly Surface Observations Reference Manual (NCC, 1970). CD 144 data used by METZ include the station number, year, month, day, hour, cloud ceiling height, wind direction, wind speed, dry bulb temperature and total opaque sky cover. The other data available on the CD 144 tape are not used by METZ. Table I-1 describes the data parameters and format required by METZ. Note that these data parameters and format are the same as required by the EPA CRSTER preprocessor program. Each record of the surface data file must contain only 1 hour of card image data. METZ references the surface data file via unit number 8.

I.2.3 Mixing Depth Data

METZ requires daily minimum and maximum mixing depths in punched card format, as determined from NWS 1200 GMT upper air temperature soundings using the methods of Holzworth (1972). The methodology for calculating hourly mixing depths from the twice daily mixing depths involves interpolation using the morning and afternoon values from the current day and the morning values from the following day. This methodology differs from that used by the EPA CRSTER preprocessor program. The mixing depths for the last day of the year preceeding the year of record should not be included in the METZ mixing depth data inputs. METZ mixing depth data inputs must begin with mixing depth for the first day of the year the user is processing. However, as with the EPA CRSTER preprocessor program, the morning mixing depth for the first day of the year following the year of record must be included.

Each mixing depth data card contains the NWS upper air station number, the date and the values for morning and afternoon mixing depths. Table I-2 is a description of the mixing depth card input format. Mixing depth data on tape are available from the NCC. METZ mixing depth card inputs must be punched from either the NCC magnetic tape data or from printed tabular data for the year and NWS upper-air station of record. Table I-3 describes the NCC mixing height (depth) magnetic tape format. Note that

TABLE I-1

DATA RECORD FORMAT FOR NCC MAGNETIC TAPES OF CD 144 SURFACE DATA - PREPROCESSOR REQUIRED DATA ONLY

Record Positions	Format	Description
1-5	I5	NWS Surface Station WBAN Number
6-7	I2	Year of Record (last two digits)
8-9	I2	Month
10-11	I2	Day
12-13	I2	Hour
14-16	3A1	Ceiling Height
17-38	22X	Blank
39-40	I2	Wind direction (Tens of degrees)
41-42	I2	Wind speed (Knots)
43-46	4X	Blank
47-49	I3	Temperature
50-78	29X	Blank
79	A1	Opaque
80	1X	Blank

TABLE I-2

METZ MIXING DEPTH DATA CARD FORMAT

Card Columns	Format	Description
1-5	I5	NWS Upper Air Station WBAN Number
6-7	I2	Year of record (last two digits)
8-9	I2	Month
10-11	I2	Day
12	1X	Blank
13-17	F5.0	Morning Mixing Depth (m)
18-30	13X	Blank
31-35	F5.0	Afternoon Mixing Depth (m)

TABLE I-3

DATA RECORD FORMAT FOR NCC MAGNETIC TAPES OF MORNING AND AFTERNOON MIXING HEIGHTS (DEPTHS)

Record Positions	Format	Description
1-5	I5	NWS Upper Air Station WBAN Number
6-7	I2	Year of record (last two digits)
8-9	I2	Month
10	I1	Season (1 = Dec.-Feb., 2 = Mar.-May, 3 = June-Aug., 4 = Sept.-Nov.)
11-12	I2	Day
13	A1	Type Code (P = precipitation, C = morning average temperature plus 5°C is less than 1200 GMT surface temperature, M = missing)
14-17	I4	Morning Mixing Height (m)
18-20	I3	Morning* Surface Wind Speed (m s^{-1})
21-23	I3	Morning Wind Speed Averaged from Surface through Mixing Layer (m s^{-1})
24	A1	Type Code (P = precipitation, C = afternoon average temperature is less than 1200 GMT surface temperature, M = missing)
25-28	I4	Afternoon Mixing Height (m)
29-31	I3	Afternoon** Surface Wind Speed (m s^{-1})
32-34	I3	Afternoon Wind Speed Averaged from Surface through Mixing Layer (m s^{-1})

* 0200-0600 LST

** 1200-1600 LST

the NCC tape format is not the same as the format required by METZ for the mixing depth data card input.

METZ references the mixing depth data via unit number 5. Therefore, the mixing depth data can be punched on cards and inserted immediately after the METZ program control input cards or, if card image data exists on a disk file, this file can be "@ADD'ed" to the runstream after the program control input cards.

I.3 OUTPUT DESCRIPTION

The METZ preprocessor program produces both print output and either disk file or punched card output. The first page of the print output lists the program control card input data as well as the station number and year of the mixing depth data. The remainder of the print output lists the SHORTZ hourly meteorological inputs with 3.5 days of inputs listed per page. Tables I-4 and I-5 show respectively an example of the first page of METZ print output and an example page of the METZ listing of SHORTZ hourly meteorological inputs. As shown by Table I-5, the SHORTZ meteorological inputs printed include wind direction (degrees), wind speed (meters per second), rural/urban mixing depth (meters), temperature (degrees Kelvin), arid/humid vertical potential temperature gradient (degrees Kelvin per meter) and actual/modified stability category. Other parameters listed include year, month, day, hour, Julian Day and time of sunrise and sunset. If ISW(4) equals "0", hourly meteorological inputs are printed for all days of the year. If ISW(4) equals "1", only the hourly meteorological inputs for the days specified by parameter IDAYS are printed.

Both the punched card and disk file output consists of the hour, wind direction, wind speed, mixing depth, temperature, vertical potential temperature gradient, stability category and lateral diffusion coefficient. The format of both the punched cards and the card image disk file is that required by SHORTZ and described in Section 3.2.3. Note that the Pasquill

TABLE I-4

TEST SHORTZ PREPROCESSOR WITH CAPE GIRARDEAU/SALEM, ILL DATA

```
ISW(1) = 0 - USE ACTUAL (0) OR MODIFIED (1) STABILITY CATEGORY.
ISW(2) = 1 - USE HUMID (0) OR ARID (1) VERTICAL POTENTIAL TEMPERATURE GRADIENTS.
ISW(3) = 0 - COMPUTE RURAL (0) OR URBAN (1) MIXING DEPTHS.
ISW(4) = 0 - PROCESS ALL (0) OR SELECTED (1) DAYS.
ISW(5) = 1 - PUNCH CARDS (0) OR WRITE TO A DISC FILE (1).

IST =  3935 - NWS SURFACE STATION WBAN NUMBER
IYR = 75 - YEAR OF SURFACE STATION
ALAT = 37.2 - LATITUDE OF SURFACE STATION
ALONG =  89.6 - LONGITUDE OF SURFACE STATION
ZONE = 6. - SURFACE STATION TIME ZONE
ALPHA =  .90 - LATERAL DIFFUSION COEFFICIENT
CON =   100.0 - RURAL MIXING DEPTH CONSTANT

MIXING DEPTH DATA IS AT STATION  3879 FOR YEAR 75

NOTE: WIND SPEED OF 1.00* INDICATES AN HOUR OF CALM WINDS.
      WIND SPEED OF 1.00 INDICATES WIND SPEED GREATER THAN 0, BUT LESS THAN 1.00 M/SEC.
```

TABLE I-5

TEST SHORTZ PREPROCESSOR WITH CAPE GIRARDEAU/SALEM, ILL DATA

```
HOUR (LOCAL TIME)             1      2      3      4      5      6      7      8      9     10     11     12
WIND DIRECTION (DEG)        333.   301.   312.   304.   303.   311.   309.   293.   306.   327.   316.   330.   YEAR =          75
WIND SPEED (M/S)            3.60   4.63   5.66   4.12   4.63   4.12   2.06   2.57   3.60   5.14   6.17   6.17   MONTH =          1
RURAL MIXING DEPTH (M)      360.   360.   360.   360.   360.   360.   360.   407.   453.   500.   547.   593.   DAY =            1
TEMPERATURE (DEG K)        278.7  278.7  278.2  276.5  275.9  274.8  274.3  273.7  274.3  275.9  277.0  277.6   JULIAN DAY =     1
ARID  DLTH/DZ (DEG K/M)     .005   .005   .000   .005   .005   .010   .030   .010   .000   .005   .000   .000   SUNRISE =   7.287
STABILITY (ACTUAL)             4      4      4      4      4      5      6      4      3      4      4      4   SUNSET =   16.769

HOUR (LOCAL TIME)            13     14     15     16     17     18     19     20     21     22     23     24
WIND DIRECTION (DEG)        352.    25.   341.   327.   336.   343.   338.   340.   345.   340.   338.   336.   YEAR =          75
WIND SPEED (M/S)            6.17   4.12   5.14   4.12   3.09  1.00*  1.00*  1.00*  1.00*  1.00*  1.00*  1.00*   MONTH =          1
RURAL MIXING DEPTH (M)      640.   687.   733.   780.   537.   293.    50.    50.    50.    50.    50.    50.   DAY =            1
TEMPERATURE (DEG K)        279.7  279.8  279.8  279.3  277.0  276.5  274.3  273.7  272.6  272.0  270.9  270.9   JULIAN DAY =     1
ARID  DLTH/DZ (DEG K/M)     .000   .000   .005   .005   .030   .040   .040   .040   .040   .040   .040   .040   SUNRISE =   7.287
STABILITY (ACTUAL)             4      3      4      4      6      7      7      7      7      7      7      7   SUNSET =   16.769

HOUR (LOCAL TIME)             1      2      3      4      5      6      7      8      9     10     11     12
WIND DIRECTION (DEG)        341.   340.   344.   345.   341.   345.   341.   336.    88.   112.   123.   153.   YEAR =          75
WIND SPEED (M/S)           1.00*  1.00*  1.00*  1.00*  1.00*  1.00*  1.00*  1.00*   4.12   3.60   5.14   3.09   MONTH =          1
RURAL MIXING DEPTH (M)       50.    50.    50.    50.    50.    50.    50.   116.   183.   249.   316.   382.   DAY =            2
TEMPERATURE (DEG K)        270.4  269.3  269.8  269.3  269.3  269.3  269.3  269.3  272.6  273.7  274.3  274.8   JULIAN DAY =     2
ARID  DLTH/DZ (DEG K/M)     .040   .040   .040   .040   .040   .040   .040   .000   .005   .005   .005   .010   SUNRISE =   7.289
STABILITY (ACTUAL)             7      7      7      7      7      7      7      3      4      4      4      4   SUNSET =   16.781

HOUR (LOCAL TIME)            13     14     15     16     17     18     19     20     21     22     23     24
WIND DIRECTION (DEG)        109.    96.   123.   131.   230.    89.    29.   116.   148.   150.   185.   176.   YEAR =          75
WIND SPEED (M/S)            4.12   3.09   5.14   6.17   2.57   2.06   1.54   2.06   1.54   3.60   3.09   3.09   MONTH =          1
RURAL MIXING DEPTH (M)      449.   515.   582.   648.   545.   443.   340.   340.   340.   340.   340.   340.   DAY =            2
TEMPERATURE (DEG K)        276.5  278.2  278.2  278.2  277.6  276.5  275.9  275.4  275.4  275.4  275.9  277.0   JULIAN DAY =     2
ARID  DLTH/DZ (DEG K/M)     .005   .000   .005   .000   .010   .020   .020   .010   .020   .005   .010   .010   SUNRISE =   7.289
STABILITY (ACTUAL)             4      3      4      4      4      5      4      4      4      4      4      4   SUNSET =   16.781

HOUR (LOCAL TIME)             1      2      3      4      5      6      7      8      9     10     11     12
WIND DIRECTION (DEG)        191.   204.   199.   222.   248.   284.   189.   195.   215.   230.   251.   280.   YEAR =          75
WIND SPEED (M/S)            6.17   4.12   5.14   3.60   4.12   3.60   2.57   2.57   2.57   4.12   6.17   4.12   MONTH =          1
RURAL MIXING DEPTH (M)      340.   340.   340.   340.   340.   340.   340.   395.   449.   504.   558.   613.   DAY =            3
TEMPERATURE (DEG K)        277.6  277.6  277.6  277.6  277.6  277.6  277.0  276.5  277.0  278.2  278.7  279.3   JULIAN DAY =     3
ARID  DLTH/DZ (DEG K/M)     .000   .005   .005   .005   .005   .005   .010   .010   .010   .005   .000   .000   SUNRISE =   7.291
STABILITY (ACTUAL)             4      4      4      4      4      4      4      4      4      4      4      3   SUNSET =   16.794

HOUR (LOCAL TIME)            13     14     15     16     17     18     19     20     21     22     23     24
WIND DIRECTION (DEG)        276.   276.   295.   313.   318.   318.   300.   272.   283.   284.   266.   286.   YEAR =          75
WIND SPEED (M/S)            5.14   5.14   5.14   4.12   6.17   4.12   2.06   1.54   1.54   1.54   1.54   1.54   MONTH =          1
RURAL MIXING DEPTH (M)      667.   722.   776.   931.   595.   359.   123.   123.   123.   123.   123.   123.   DAY =            3
TEMPERATURE (DEG K)        279.3  279.3  278.7  279.2  277.0  276.5  274.3  273.2  273.2  273.2  272.6  272.0   JULIAN DAY =     3
ARID  DLTH/DZ (DEG K/M)     .005   .005   .005   .005   .000   .005   .030   .040   .040   .040   .040   .040   SUNRISE =   7.291
STABILITY (ACTUAL)             4      4      4      4      4      4      6      7      7      7      7      7   SUNSET =   16.794

HOUR (LOCAL TIME)             1      2      3      4      5      6      7      8      9     10     11     12
WIND DIRECTION (DEG)        291.   291.   273.   256.   267.   293.   283.   276.   281.   210.   207.   212.   YEAR =          75
WIND SPEED (M/S)           1.00*  1.00*   1.54   1.54   1.54   1.54  1.00*  1.00*  1.00*   2.57   2.57   4.12   MONTH =          1
RURAL MIXING DEPTH (M)      123.   123.   123.   123.   123.   123.   123.   222.   321.   420.   520.   619.   DAY =            4
TEMPERATURE (DEG K)        271.5  270.9  270.4  270.4  270.4  269.3  269.8  269.8  271.5  274.3  275.4  276.5   JULIAN DAY =     4
ARID  DLTH/DZ (DEG K/M)     .040   .040   .040   .040   .040   .040   .040   .000   .000   .000   .000   .000   SUNRISE =   7.292
STABILITY (ACTUAL)             7      7      7      7      7      7      7      3      2      3      3      3   SUNSET =   16.907
```

G category (category 7) is converted to the Pasquill F category (category 6) for output to cards or disk.

Use of the preprocessor output is best explained by referencing Section 3.2.2 in the main body of the report. If output is in the form of punched cards (METZ control parameter ISW(5) equals "0"), simply insert the cards as Card Group 11 in the SHORTZ input deck (see Table 3-5). The correct card input order is shown in Figure 3-1. If METZ output is written to a disk file (METZ control parameter ISW(5) equals "1"), replace SHORTZ input Card Group 11 with the following UNIVAC ECL control statement:

```
@ADD    out-file
```

where

out-file = METZ output disk file as described in Section I.4.1

Also, check to insure that SHORTZ input parameter NDAYS is equal to the total number of days of proprocessed meteorological inputs inserted in the SHORTZ input deck.

I.4 CONTROL LANGUAGE AND DATA DECK SETUP

I.4.1 Control Language Requirements

The following illustrates the required ECL control statement run-stream for a typical run on a UNIVAC 1100/60 Operating System:

```
@RUN, priority      jobid,account,userid, time, pages

@ASG,A              prog-file.

@ASG,A              cd144-file.
```

```
@USE              8.,cd144-file.

                                  { Optional, required only when the
@ASG,A            mix-file.       { mixing depth card image data are in
                                  { a disk file.  The file is "@ADD'ed"
                                  { to the runstream later.

@ASG,UP           out-file.       { Optional, required only when SHORTZ
                                  { hourly meteorological inputs are
@USE              9.,out-file.    { written to a disk file (ISW(5)="1")

@XQT              prog-file.METZ

card-input-data

mix-depth-cards
     or
@ADD mix-file                     { Required if the mixing depth data
                                  { cards have been placed in a disk
                                  { file.
@FIN
```

where,

priority = job run priority

jobid = six-character user supplied job identification or terminal site identification name.

account = account number

userid = 12 character user supplied project number or user number time = execution time required in minutes

pages = output pages required

prog-file = the name of the program file. This example assumes the user has assembled and collected the METZ preprocessor program into prog-file and called the absolute program METZ.

cd144-file = the name of the file containing the CD 144 surface data inputs. Each record of cd144-file must contain only 1 hour of surface data. METZ references cd144-file via unit number 8.

mix-file = the name of the file containing card image mixing depth data. This file is not required if mixing depth data are to be read directly from punched cards which follow the METZ program control input cards.

out-file = the name of the disk file which will receive the SHORTZ meteorological data inputs. This file is used only if ISW(5) equals "1". METZ references out-file by unit number 9.

card-input-data = METZ preprocesser program control input cards as described in Section I.4.2.

mix-depth-cards = Twice daily mixing depth card data. These mixing depth data cards should be placed immediately after the program control input cards. If the mixing depth data cards have been stored on a disk file, use the statement "@ADD mix-file" to insert the data into the runstream after the program control input cards.

I.4.2 Control Input Data Deck Setup

The brief control input data deck outlined below is followed in Table I-6 by a more detailed description of METZ control card input requirements. The control input data cards follow the @XQT statement in the following order:

- Card No. 1 - Title card
- Card No. 2 - Program control options
- Card No. 3 - Surface station information and user input program constants
- Cards No. 4 through No. 8 - Day selection information. These 5 cards are omitted if ISW(4) equals "0".

I.5 PROGRAM RUN TIME, PAGE AND CARD OUTPUT

Run Time

The run time required to process and output a full year of data is approximately 3 minutes on an UNIVAC 1100/60-H2 Computer. Processing only selected days will decrease run time, but not in direct proportion to the number of days processed. Consequently, the user should allow up to 3 minutes of run time for each run.

Page Output

Print output consists of one program control data output page and one page for every 3.5 days processed. Therefore the total number of pages printed will be:

TABLE I-6

METZ PROGRAM CARD INPUT PARAMETERS, FORTRAN EDIT CODE (FORMAT) AND DESCRIPTION

Card Number	Parameter Name	Card Columns	Fortran Edit Code (Format)	Description
1	ITITLE	1-80	40A2	80-character heading label printed at the top of each page of print output.
2	ISW(1)	1-2	I2	Default = 0 = Actual Pasquill stability category computed for each hour is used. 1 = Modified Pasquill stability category (stability does not vary by more than one category from one hour to the next) is used.
	ISW(2)	3-4	I2	Default = 0 = Use humid values of vertical potential temperature gradients. 1 = Use arid values of vertical potential temperature gradients.
	ISW(3)	5-6	I2	Default = 0 = Compute rural mixing depths. 1 = Compute urban mixing depths.
	ISW(4)	7-8	I2	Default = 0 = Output SHORTZ hourly meteorological inputs for all days of the year. Omit input cards 4-8. 1 = Output SHORTZ hourly meteorological inputs only for those days selected via the IDAYS parameter on input cards 4-8.
	ISW(5)	9-10	I2	Default = 0 = SHORTZ hourly meteorological data inputs are punched on cards. 1 = Write SHORTZ hourly meteorological data inputs on a disk file referenced by unit number 9.

TABLE I-6 Continued

Card Number	Parameter Name	Card Columns	Fortran Edit Code (Format)	Description
3	IST	1-5	I5	National Weather Service surface station WBAN number.
	IYR	6-7	I2	Year of surface data.
	ALAT	9-18	F10.0	Surface station latitude.
	ALONG	19-28	F10.0	Surface station longitude.
	ZONE	29-30	F2.0	Surface station time zone: Eastern=5, Central=6, Mountain=7, Pacific=8.
	A	45-48	F4.0	Lateral diffusion coefficient. Default = 0.9.
	CON	49-54	F6.0	Rural mixing depth constant. Default = 100.
4-8	IDAYS	1-80	80I1	366 entries where each entry corresponds to a Julian Day. A "1" in a column signifies that the corresponding Julian Day of surface and mixing depth data will be processed and SHORTZ hourly meteorological inputs will be output to cards or a disk file for hours 01 through 24. A "0" signifies no output for the corresponding Julian Day. Omit this parameter if ISW(4) equals "0".

$$\text{No. of Pages} = 1 + \text{NDAYS}/3.5 \qquad \text{(I-1)}$$

where,

NDAYS = the total number of days processed. If ISW(4) equals "0", NDAYS equals either "365" or "366" for leap years. If ISW(4) equals "1", NDAYS equals the number of days selected through the IDAYS parameter to be processed.

Card Output

One card is punched for each hour of data processed. Similarly, one record is written to the disk file (unit number 9) for each hour processed. Therefore, the total number of cards punched or of records written to file is 24•NDAYS.

I.6 PROGRAM DIAGNOSTIC MESSAGES

METZ performs several checks on the surface data and mixing depth data to insure dates and station numbers agree with user input and to guarantee data inputs are not out of order. All error messages terminate program execution so that the user can correct data input errors before continuing. A list of diagnostic messages with explanations is given in Table I-7.

Diagnostic Messages 1, 3 and 4 also list (in addition to the messages described in Table I-7) the surface data for the day being processed by the preprocessor program when the error occurred. This feature enables quick identification and correction of most data check errors encountered. The surface data are listed in the following format:

TABLE I-7

1.

```
*** JULIAN DAY OF SURFACE MET DATA IS IN ERROR ***
JULIAN DAY SHOULD BE xxx BUT IS xxx MONTH AND DAY ARE RESPECTIVELY xx xx
```

The CD 144 surface data month and day are checked to insure proper sequence of data. If this message appears, the surface data are not in sequential order. Locate the month and day of data as indicated in the message and correct.

2.

```
*** DATES OF MIXING DEPTH DATA AND SURFACE DATA DO NOT AGREE ***
MIXING DEPTH DATA YEAR, MONTH, DAY =  xx xx xx
SURFACE DATA YEAR, MONTH, DAY      =  xx xx xx
```

Dates of surface data and mixing depth data must agree. Check both days indicated in the error message and correct appropriately.

3.

```
*** STATION NUMBER OR YEAR OF SURFACE MET DATA IS IN ERROR ***
CONTROL CARD WBAN NO. = xxx  SURFACE STATION WBAN NO. = xxx
CONTROL CARD YEAR = xx   SURFACE STATION YEAR = xx
```

CD 144 surface data station WBAN number and year of data are checked with user input station WBAN number IST and year of surface data IYR. Check program control input Card No. 3 to eliminate possible key punch errors. Also check CD 144 surface data for an incorrect station WBAN number or year.

4.

```
*** HOUR OF SURFACE DATA IS IN ERROR ***
HOUR SHOULD BE xx BUT IS xx
```

Each hour of CD 144 surface data is checked for proper sequence. Determine which hour of data is out of sequence and correct.

```
 SURFACE DATA FOR THE DAY CURRENTLY BEING PROCESSED ARE:
STA NO  YR  MO  DY  HR  CEILING  WIND DIR  WIND SPD  TEMP  SKY
XXXXX   XX  XX  XX  01    XXX      XXX       XXX      XXX   X
XXXXX   XX  XX  XX  02    XXX      XXX       XXX      XXX   X
         .                 .                  .             .
         .                 .                  .             .
         .                 .                  .             .
         .                 .                  .             .
         .                 .                  .             .
XXXXX   XX  XX  XX  24    XXX      XXX       XXX      XXX   X
```

REFERENCES

Environmental Protection Agency, 1977: User's manual for Single Source (CRSTER) Model. EPA Report No. EPA-450/2-77-013, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Holzworth, G. C., 1972: Mixing heights, wind speeds and potential for urban air pollution throughout the contiguous United States. Publication No. AP-101, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina.

National Climatic Center, 1977: Card Deck 144 WBAN Hourly Surface Observations Reference Manual, National Climatic Center, Asheville, North Carolina.

Turner, D. B., 1964: A diffusion model for an urban area. Journal of Applied Meteorology, 3(1), 83-91.

COMPLETE FORTRAN LISTING OF THE SHORTZ METEOROLOGICAL PREPROCESSOR (METZ) COMPUTER PROGRAM

```
C.....                                                                  S0100010
C..... PROGRAM METZ - SHORTZ METEOROLOGICAL DATA PREPROCESSOR           S0100020
C.....                                                                  S0100030
C..... CARD INPUT.                                                      S0100040
C.....                                                                  S0100050
C..... CARD 1: (40A2)                                                   S0100060
C.....         ITITLE = 80 CHARACTER INFORMATION TITLE PRINTED AT THE   S0100070
C.....         TOP OF EACH PAGE OF OUTPUT.                              S0100080
C.....                                                                  S0100090
C..... CARD 2: (5I2)                                                    S0100100
C.....         ISW(1) = 0 - USE THE ACTUAL STABILITY CATEGORY COMPUTED  S0100110
C.....                      FOR EACH HOUR REGARDLESS OF THE VARIATION   S0100120
C.....                      FROM THE PREVIOUS HOUR.                     S0100130
C.....                = 1 - DO NOT ALLOW THE STABILITY CATEGORY TO VARY S0100140
C.....                      MORE THAN ONE CATEGORY EACH HOUR. THIS METHOS0100150
C.....                      IS USED BY ALL EPA MODELS.                  S0100160
C.....         ISW(2) = 0 - USE HUMID VERTICAL POTENTIAL TEMPERATURE    S0100170
C.....                      GRADIENTS.                                  S0100180
C.....                = 1 - USE ARID VERTICAL POTENTIAL TEMPERATURE     S0100190
C.....                      GRADIENTS.                                  S0100200
C.....         ISW(3) = 0 - COMPUTE RURAL MIXING DEPTHS.                S0100210
C.....                = 1 - COMPUTE URBAN MIXING DEPTHS.                S0100220
C.....         ISW(4) = 0 - PRODUCE SHORTZ METEOROLOGICAL INPUT DATA FORS0100230
C.....                      ALL DAYS OF THE YEAR.                       S0100240
C.....                = 1 - PRODUCE SHORTZ METEOROLOGICAL DATA INPUT    S0100250
C.....                      ONLY FOR THE DAYS SPECIFIED ON CARDS 4      S0100260
C.....                      THROUGH 8 (IDAYS).  IF ISW(4) = 1 AND ISW(1)S0100270
C.....                      = 1, THE USER MUST PROCESS THE DAY BEFORE   S0100280
C.....                      THE DAY OF INTEREST TO INSURE THE STABILITY S0100290
C.....                      CATEGORIES WILL BE CORRECT.                 S0100300
C.....         ISW(5) = 0 - PUNCH THE SHORTZ METEOROLOGICAL INPUT DATA  S0100310
C.....                      ON CARDS.                                   S0100320
C.....                = 1 - WRITE THE SHORTZ METEOROLOGICAL INPUT DATA  S0100330
C.....                      TO THE DISC FILE REFERENCED BY UNIT 9.      S0100340
C..... CARD 3: (I5,I2,1X,2F10.0,F2.0,14X,F4.0,F6.0)                     S0100350
C.....         IST = NWS SURFACE STATION WBAN NUMBER.                   S0100360
C.....         IYR = YEAR OF SURFACE DATA.                              S0100370
C.....         ALAT = LATITUDE OF SURFACE STATION.                      S0100380
```

```
C.....         ALONG = LONGITUDE OF SURFACE STATION.                    S0100390
C.....         ZONE = TIME ZONE IN WHICH THE SURFACE STATION IS LOCATED.S0100400
C.....                5 = EASTERN.        7 = MOUNTAIN.                 S0100410
C.....                6 = CENTRAL.        8 = PACIFIC.                  S0100420
C.....         A = LATERAL DIFFUSION COEFFICIENT. DEFAULT = 0.9.        S0100430
C.....         CON = RURAL MIXING DEPTH CONSTANT. DEFAULT = 100.        S0100440
C.....                                                                  S0100450
C..... CARDS 4-8: (80I1) OMIT IF ISW(4) = 0                             S0100460
C.....            IDAYS = 0 - DO NOT PRODUCE SHORTZ METEOROLOGICAL DATA S0100470
C.....                        INPUT FOR THE CORRESPONDING DAY.          S0100480
C.....                  = 1 - PRODUCE SHORTZ METEOROLOGICAL DATA INPUT  S0100490
C.....                        FOR THIS DAY.                             S0100500
C.....                                                                  S0100510
C.....                                                                  S0100520
C..... UNIT NUMBER 5 = CONTROL CARD INPUT DATA AND MIXING DEPTH DATA.   S0100530
C..... UNIT NUMBER 8 = CD144 SURFACE DATA IN CARD IMAGE FORMAT.         S0100540
C..... UNIT NUMBER 9 = OUTPUT FILE USED IF USER IS WRITING SHORTZ       S0100550
C.....                 METEOROLOGICAL INPUTS TO A DISC FILE.            S0100560
C.....                                                                  S0100570
C.....                                                                  S0100580
      INTEGER PT(22), FLG(24), AS(5), APTG(3), AHM(3)                   S0100590
      INTEGER ASTAB(6)                                                  S0100600
      DIMENSION MET1(12,24), MET2(12,24), ISW(5), JUL(12,2), ITITLE(40),S0100610
     . SPD(24), DIR(24), TEMP(24), KST(24), PTG(24), HM(24),            S0100620
     . IDAYS(366), RAND(24), VPOT(12,6), IDG(3), IDIG(11), LSTAB(12,7), S0100630
     . ANC(3)                                                           S0100640
      COMMON /CSRSS/ SLAT, CLAT, T, C1                                  S0100650
      DATA JUL /0, 31, 59, 90, 120, 151, 181, 212, 243, 273, 304, 334,  S0100660
     . 0, 31, 60, 91, 121, 152, 182, 213, 244, 274, 305, 335/           S0100670
      DATA IDAYS /366*1/                                                S0100680
      DATA PT /3*1, 3*2, 4*3, 6*4, 5*5, 6/                              S0100690
      DATA VPOT /36*0.0, 0.015, 0.010, 0.005, 3*0.003, 0.020, 0.010,    S0100700
     . 0.005, 3*0.0, 0.030, 0.020, 0.015, 0.010, 2*0.003, 0.030, 0.020, S0100710
     . 0.010, 0.005, 2*0.0, 0.035, 0.025, 0.015, 0.010, 2*0.003, 0.040, S0100720
     . 0.030, 0.020, 0.010, 0.005, 0.0/                                 S0100730
      DATA IDIG / 1H0, 1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9, 1H-/S0100740
      DATA LSTAB /3*7, 3*6, 4*5, 4,4,3*6, 3*5, 18*4, 3*3, 9*4, 3*2,     S0100750
     . 6*3, 3*4, 1, 6*2, 4*3, 4, 5*1, 4*2, 3*3/                         S0100760
```

```
      DATA ANG /60.0, 35.0, 15.0/                                       S0100770
      DATA ALPHA /0.9/                                                  S0100780
      DATA AS /2H(M, 2HOD, 2HIF, 2HIE, 2HD)/                            S0100790
      DATA APTG /2H H, 2HUM, 2HID/                                      S0100800
      DATA AHM /2H R, 2HUR, 2HAL/                                       S0100810
      DATA ASTAB /1HA, 1HB, 1HC, 1HD, 1HE, 1HF/                         S0100820
C.....                                                                  S0100830
C..... INITIALIZE.                                                      S0100840
C.....                                                                  S0100850
      IHM = 5                                                           S0100860
      ICD = 8                                                           S0100870
      ISHZ = 9                                                          S0100880
      IO = 6                                                            S0100890
      LST = -1                                                          S0100900
      NREAD = 24                                                        S0100910
      NTDY = 366                                                        S0100920
      NDP = 8                                                           S0100930
      NTDP = 0                                                          S0100940
      C1 = 57.29578                                                     S0100950
C.....                                                                  S0100960
C..... READ CONTROL CARD INPUT.                                         S0100970
C.....                                                                  S0100980
      READ (IHM,1200) ITITLE                                            S0100990
      READ (IHM,1010) ISW                                               S0101000
      READ (IHM,1020) IST, IYR, ALAT, ALONG, ZONE, A, CON               S0101010
      IF (ISW(4) .EQ. 1) READ (IHM,1030) IDAYS                          S0101020
      IF (A .NE. 0.0) ALPHA = A                                         S0101030
      IF (CON .LE. 0.0) CON = 100.                                      S0101040
      IF (ISW(1) .EQ. 1) GO TO 5                                        S0101050
      AS(1) = 2H(A                                                      S0101060
      AS(2) = 2HCT                                                      S0101070
      AS(3) = 2HUA                                                      S0101080
      AS(4) = 2HL)                                                      S0101090
      AS(5) = 2H                                                        S0101100
    5 IF (ISW(2) .EQ. 0) GO TO 10                                       S0101110
      APTG(1) = 2H A                                                    S0101120
      APTG(2) = 2HRI                                                    S0101130
      APTG(3) = 2HD                                                     S0101140
```

```
   10 IF (ISW(3) .EQ. 0) GO TO 15                                      S0101150
      AHM(1) = 2H U                                                     S0101160
      AHM(2) = 2HRB                                                     S0101170
      AHM(3) = 2HAN                                                     S0101180
   15 CONTINUE                                                          S0101190
      T = ALAT/C1                                                       S0101200
      SLAT = SIN(T)                                                     S0101210
      CLAT = COS(T)                                                     S0101220
      T = ALONG/15.0 - ZONE                                             S0101230
      TZ = 15.*ZONE - ALONG                                             S0101240
C.....                                                                  S0101250
C..... WRITE CONTROL CARD INPUT TO UNIT IO.                              S0101260
C.....                                                                  S0101270
      WRITE (IO,1210) ITITLE                                            S0101280
      WRITE (IO,1070) ISW                                               S0101290
      WRITE (IO,1080) IST, IYR, ALAT, ALONG, ZONE, ALPHA, CON           S0101300
      IF (ISW(4) .EQ. 1) WRITE (IO,1090) IDAYS                          S0101310
C.....                                                                  S0101320
C..... LEAP YEAR ?? LYR=1=NO, LYR=2=YES.                                 S0101330
C.....                                                                  S0101340
      LYR = 1                                                           S0101350
      N = IYR - 4*(IYR/4)                                               S0101360
      IF (N .EQ. 0) LYR = 2                                             S0101370
      IF (LYR .EQ. 1) NTDY = 365                                        S0101380
C.....                                                                  S0101390
C..... SKIP FIRST HOUR OF MET DATA (HOUR 0). INITIALIZE WIND SPEED FOR    S0101400
C..... RURAL MIXING DEPTH CALCULATIONS AND WIND DIRECTION FOR CALM       S0101410
C..... HOURS.                                                            S0101420
C.....                                                                  S0101430
      READ (ICD,1040) (MET1(I,1),I=1,8), LWD, (MET1(I,1),I=10,12)       S0101440
      WSAVG = MET1(10,1)*1.0                                            S0101450
C.....                                                                  S0101460
C..... READ FIRST DAY OF SURFACE DATA.                                   S0101470
C.....                                                                  S0101480
      DO 20 N = 1,24                                                    S0101490
      READ (ICD,1040) (MET1(I,N),I=1,12)                                S0101500
   20 CONTINUE                                                          S0101510
      IF (MET1(9,1) .EQ. 0) MET1(9,1) = LWD                             S0101520
```

```
C.....                                                                  S0101530
C..... MET1(1,N) = STATION NUMBER                                       S0101540
C..... MET1(2,N) = YEAR                                                 S0101550
C..... MET1(3,N) = MONTH                                                S0101560
C..... MET1(4,N) = DAY                                                  S0101570
C..... MET1(5,N) = HOUR                                                 S0101580
C..... MET1(6-8,N) = CEILING DEPTH (100'S OF FEET)                      S0101590
C..... MET1(9,N) = WIND DIRECTION (10'S OF DEGREES)                     S0101600
C..... MET1(10,N) = WIND SPEED (KNOTS)                                  S0101610
C..... MET1(11,N) = TEMPERATURE (DEG F)                                 S0101620
C..... MET1(12,N) = OPAQUE SKY COVER (TENTHS)                           S0101630
C.....                                                                  S0101640
C..... READ MIXING DEPTH FOR DAY 1.                                      S0101650
C.....                                                                  S0101660
      READ (IHM,1055) MST, IHMY, IHMM, IHMD, HMM2, HMA2                 S0101670
      WRITE (IO,1190) MST, IHMY                                         S0101680
      WRITE (IO,1100)                                                   S0101690
C.....                                                                  S0101700
C..... COMPUTE SR AND SS FOR DAY 1.                                      S0101710
C.....                                                                  S0101720
      CALL SRSS (1, TSR2, TSS2, AMM2, DS2, DC2)                         S0101730
      ITSR2 = TSR2 + 0.5                                                S0101740
      ITSS2 = TSS2 + 0.5                                                S0101750
C.....                                                                  S0101760
C..... COMPUTE RURAL MIXING DEPTHS FOR DAY 1.                            S0101770
C.....                                                                  S0101780
      IF (ISW(3) .EQ. 1) GO TO 40                                       S0101790
      DO 30 N = 1,ITSR2                                                 S0101800
   30 WSAVG = WSAVG + MET1(10,N)*1.0                                    S0101810
      WSAVG = WSAVG*0.51444/(ITSR2+1)                                   S0101820
      IF (WSAVG .LE. 0.5) WSAVG = 0.5                                   S0101830
      HMR = CON*WSAVG                                                   S0101840
      IF (HMR .LT. HMM2) HMM2 = HMR                                     S0101850
   40 CONTINUE                                                          S0101860
C.....                                                                  S0101870
C..... BEGIN DAY LOOP                                                   S0101880
C.....                                                                  S0101890
      DO 1000 NDAY = 1,NTDY                                             S0101900
      IF (NDAY .EQ. (NTDY-1)) NREAD = 23                                S0101910
C.....                                                                  S0101920
C..... CHECK JULIAN DAY                                                 S0101930
C.....                                                                  S0101940
      JDAY = JUL(MET1(3,1),LYR) + MET1(4,1)                             S0101950
      IF (JDAY .NE. NDAY) GO TO 2010                                    S0101960
C.....                                                                  S0101970
C..... CHECK DATE OF MIXING DEPTH DATA                                  S0101980
C.....                                                                  S0101990
      IF (IHMY .NE. MET1(2,1) .OR. IHMM .NE. MET1(3,1) .OR. IHMD .NE.   S0102000
     . MET1(4,1)) GO TO 2030                                            S0102010
C.....                                                                  S0102020
C..... READ NEXT DAYS SURFACE DATA.                                     S0102030
C.....                                                                  S0102040
      IF (JDAY .EQ. NTDY) GO TO 55                                      S0102050
      DO 50 N = 1,NREAD                                                 S0102060
      READ (ICD,1040) (MET2(I,N),I=1,12)                                S0102070
   50 CONTINUE                                                          S0102080
      IF (NREAD .EQ. 24) GO TO 55                                       S0102090
      DO 53 N = 1,12                                                    S0102100
   53 MET2(N,24) = MET2(N,23)                                           S0102110
      MET2(5,24) = 0                                                    S0102120
C.....                                                                  S0102130
C..... SWAP MIXING DEPTHS, SR, SS.                                      S0102140
C.....                                                                  S0102150
   55 DS1 = DS2                                                         S0102160
      DC1 = DC2                                                         S0102170
      AMM1 = AMM2                                                       S0102180
      HMM1 = HMM2                                                       S0102190
      HMA1 = HMA2                                                       S0102200
      TSR1 = TSR2                                                       S0102210
      TSS1 = TSS2                                                       S0102220
      ITSR1 = ITSR2                                                     S0102230
      ITSS1 = ITSS2                                                     S0102240
      JD = JDAY + 1                                                     S0102250
      IF (JDAY .EQ. NTDY) JD = 1                                        S0102260
      CALL SRSS (JD, TSR2, TSS2, AMM2, DS2, DC2)                        S0102270
      ITSR2 = TSR2 + 0.5                                                S0102280
      ITSS2 = TSS2 + 0.5                                                S0102290
C.....                                                                  S0102300
C..... READ NEXT DAYS MIXING DEPTHS.                                    S0102310
C.....                                                                  S0102320
      READ (IHM,1050) IHMY, IHMM, IHMD, HMM2, HMA2                      S0102330
C.....                                                                  S0102340
C..... COMPUTE RURAL MIXING DEPTHS.                                     S0102350
C.....                                                                  S0102360
      IF (ISW(3) .EQ. 1) GO TO 80                                       S0102370
      WSAVG = 0                                                         S0102380
      NWS = 0                                                           S0102390
      DO 60 N = ITSS1+2,24                                              S0102400
      NWS = NWS + 1                                                     S0102410
   60 WSAVG = WSAVG + MET1(10,N)*1.0                                    S0102420
      IF (JDAY .EQ. NTDY) GO TO 65                                      S0102430
      DO 70 N = 1,ITSR2                                                 S0102440
      NWS = NWS + 1                                                     S0102450
   70 WSAVG = WSAVG + MET2(10,N)*1.0                                    S0102460
   65 WSAVG = WSAVG*0.51444/NWS                                         S0102470
      IF (WSAVG .LE. 0.5) WSAVG = 0.5                                   S0102480
C.....                                                                  S0102490
C..... DENOMINATOR IN AVERAGE WIND SPEED = ITSR2+24-(ITSS1+2)+1         S0102500
C.....                                                                  S0102510
      HMR = CON*WSAVG                                                   S0102520
      IF (HMR .LT. HMM2) HMM2 = HMR                                     S0102530
   80 CONTINUE                                                          S0102540
C.....                                                                  S0102550
C..... GENERATE 24 RANDOM NUMBERS UNIFORMLY DISTRIBUTED BETWEEN 0 AND 1.S0102560
C.....                                                                  S0102570
      DO 90 I = 1,24                                                    S0102580
   90 RAND(I) = UNRAN(Z)                                                S0102590
C.....                                                                  S0102600
C..... LOOP OVER HOURS.                                                 S0102610
C.....                                                                  S0102620
      DO 600 I = 1,24                                                   S0102630
      IHR = I                                                           S0102640
      IE = I                                                            S0102650
      IF (I .EQ. 24) IHR = 0                                            S0102660
```

```
C.....                                                          S0102670
C..... DATA CHECKS                                              S0102680
C.....                                                          S0102690
      IF (MET1(1,I) .NE. IST) GO TO 2000                        S0102700
      IF (MET1(2,I) .NE. IYR) GO TO 2000                        S0102710
      IF (MET1(5,I) .NE. IHR) GO TO 2020                        S0102720
C.....                                                          S0102730
C..... DETERMINE STABILITY.                                     S0102740
C.....                                                          S0102750
C..... DETERMINE OPAQUE SKY COVER.                              S0102760
C.....                                                          S0102770
      KST(I) = 0                                                S0102780
      DO 150 K = 1,11                                           S0102790
      L = K                                                     S0102800
      IF (MET1(12,I) .EQ. IDIG(K)) GO TO 160                    S0102810
  150 CONTINUE                                                  S0102820
      L = 11                                                    S0102830
  160 IOPQ = L - 1                                              S0102840
C.....                                                          S0102850
C..... DETERMINE CEILING IN 100'S OF FEET.                      S0102860
C.....                                                          S0102870
      IF (MET1(6,I) .NE. IDIG(11)) GO TO 170                    S0102880
      IDG(1) = 9                                                S0102890
      IDG(2) = 9                                                S0102900
      IDG(3) = 8                                                S0102910
      GO TO 210                                                 S0102920
  170 DO 200 K = 1,3                                            S0102930
      DO 180 L = 1,10                                           S0102940
      J = L                                                     S0102950
      IF (MET1(K+5,I) .EQ. IDIG(L)) GO TO 190                   S0102960
  180 CONTINUE                                                  S0102970
  190 IDG(K) = J - 1                                            S0102980
  200 CONTINUE                                                  S0102990
  210 ICEIL = IDG(1)*100. + IDG(2)*10. + IDG(3)                 S0103000
C.....                                                          S0103010
C..... DETERMINE RADIATION INDEX.                               S0103020
C.....                                                          S0103030
      IF (IOPQ .EQ. 10 .AND. ICEIL .LT. 70) GO TO 220           S0103040
      IF (IHR .GT. TSR1 .AND. IHR .LT. TSS1) GO TO 230                  S0103050
      IRX = 2                                                           S0103060
      IF (IOPQ .LE. 4) IRX = 1                                          S0103070
      GO TO 300                                                         S0103080
  220 IRX = 3                                                           S0103090
      GO TO 300                                                         S0103100
  230 H = (15.*(IHR-AMM1) + TZ)/C1                                      S0103110
      AL = SLAT*DS1 + DC1*CLAT*COS(H)                                   S0103120
      AL = ATAN2(AL,SQRT(1-AL*AL))*C1                                   S0103130
      DO 240 N = 1,3                                                    S0103140
      J = N                                                             S0103150
      IF (AL .GT. ANG(N)) GO TO 250                                     S0103160
  240 CONTINUE                                                          S0103170
      J = 4                                                             S0103180
  250 ISOL = 5 - J                                                      S0103190
      IF (IOPQ .GT. 5) GO TO 260                                        S0103200
      IRX = ISOL + 3                                                    S0103210
      GO TO 300                                                         S0103220
  260 IRX = ISOL - 1                                                    S0103230
      IF (ICEIL .LT. 70) GO TO 270                                      S0103240
      IF (ICEIL .LT. 160) GO TO 280                                     S0103250
      IF (IOPQ .EQ. 10) GO TO 290                                       S0103260
      IRX = ISOL                                                        S0103270
      GO TO 290                                                         S0103280
  270 IRX = ISOL - 2                                                    S0103290
      GO TO 290                                                         S0103300
  280 IF (IOPQ .EQ. 10) IRX = IRX - 1                                   S0103310
  290 IF (IRX .LT. 1) IRX = 1                                           S0103320
      IRX = IRX + 3                                                     S0103330
  300 IWS = MET1(10,I)                                                  S0103340
      IF (IWS .GT. 12) IWS = 12                                         S0103350
      IF (IWS .LE. 1) IWS = 1                                           S0103360
      KST(I) = LSTAB(IWS,IRX)                                           S0103370
C.....                                                                  S0103380
C..... OPTION TO ALLOW STABILITY TO VARY NO MORE THAN 1 CATEGORY.        S0103390
C.....                                                                  S0103400
      IF (ISW(1) .EQ. 0) GO TO 400                                      S0103410
      IF (LST .LT. 0) LST = KST(I)                                      S0103420
      J = KST(I) - LST                                                  S0103430
      IF (J .GT. 1) KST(I) = LST + 1                                    S0103440
      IF (J .LT. -1) KST(I) = LST - 1                                   S0103450
  400 IF (KST(I) .LT. 1) KST(I) = 1                                     S0103460
      IF (KST(I) .GT. 7) KST(I) = 7                                     S0103470
      LST = KST(I)                                                      S0103480
C.....                                                                  S0103490
C..... CHECK IF CURRENT DAY IS TO BE PROCESSED.                         S0103500
C.....                                                                  S0103510
      IF (IDAYS(NDAY) .EQ. 0) GO TO 600                                 S0103520
C.....                                                                  S0103530
C..... CONVERT WIND SPEED FROM KNOTS TO M/S.                             S0103540
C.....                                                                  S0103550
      SPD(I) = MET1(10,I)*0.51444                                       S0103560
      IF (SPD(I) .LT. 1.0) SPD(I) = 1.0                                 S0103570
      FLG(I) = 1H                                                       S0103580
C.....                                                                  S0103590
C..... CHECK FOR CALM WINDS, RANDOMIZE WIND DIRECTIONS.                  S0103600
C.....                                                                  S0103610
      IF (MET1(9,I) .EQ. 0) GO TO 130                                   S0103620
      LWD = MET1(9,I)                                                   S0103630
      GO TO 140                                                         S0103640
  130 MET1(9,I) = LWD                                                   S0103650
      FLG(I) = 1H*                                                      S0103660
  140 DIR(I) = MET1(9,I)*10.                                            S0103670
      IRAND = RAND(I)*10.                                               S0103680
      DIR(I) = DIR(I) + IRAND - 4.0                                     S0103690
      IF (DIR(I) .GT. 360.0) DIR(I) = DIR(I) - 360.0                    S0103700
C.....                                                                  S0103710
C..... CONVERT TEMPERATURE FROM F TO K.                                  S0103720
C.....                                                                  S0103730
      TEMP(I) = 0.5556*(MET1(11,I)-32.0) + 273.15                       S0103740
C.....                                                                  S0103750
C..... DETERMINE VERTICAL POTENTIAL TEMPERATURE GRADIENT.                S0103760
C.....                                                                  S0103770
      IWS = MET1(10,I)                                                  S0103780
      IF (IWS .LE. 1) IWS = 1                                           S0103790
      IF (IWS .GT. 21) IWS = 22                                         S0103800
      IWS = PT(IWS)                                                     S0103810
      J = ISW(2)*6                                                      S0103820
      L = KST(I)                                                        S0103830
      IF (L .GT. 6) L = 6                                               S0103840
      PTG(I) = VPOT(J+IWS,L)                                            S0103850
C.....                                                                  S0103860
C..... COMPUTE MIXING DEPTHS.                                           S0103870
C.....                                                                  S0103880
      IF (I .GT. ITSR1) GO TO 510                                       S0103890
      HM(I) = HMM1                                                      S0103900
      GO TO 590                                                         S0103910
  510 IF (I .GT. 16) GO TO 520                                          S0103920
      HM(I) = HMM1 + (HMA1-HMM1)*(I-ITSR1)/(16-ITSR1)                   S0103930
      GO TO 590                                                         S0103940
  520 IF (I .GE. (ITSS1+2)) GO TO 530                                   S0103950
      HM(I) = HMA1 - (HMA1-HMM2)*(I-16)/(ITSS1-14)                      S0103960
      GO TO 590                                                         S0103970
  530 HM(I) = HMM2                                                      S0103980
  590 CONTINUE                                                          S0103990
  600 CONTINUE                                                          S0104000
C.....                                                                  S0104010
C..... END HOUR LOOP.                                                   S0104020
C.....                                                                  S0104030
C..... OUTPUT SECTION.                                                  S0104040
C.....                                                                  S0104050
      IF (IDAYS(NDAY) .EQ. 0) GO TO 900                                 S0104060
      NTDP = NTDP + 1                                                   S0104070
      DO 650 I = 1,24                                                   S0104080
      J = DIR(I) + 0.5                                                  S0104090
      K = HM(I) + 0.5                                                   S0104100
      L = KST(I)                                                        S0104110
      IF (L .GT. 6) L = 6                                               S0104120
      L = ASTAB(L)                                                      S0104130
      IF (ISW(5) .EQ. 0) GO TO 630                                      S0104140
      WRITE (ISHZ,1060) I, J, SPD(I), K, TEMP(I), PTG(I), L, ALPHA      S0104150
      GO TO 650                                                         S0104160
  630 PUNCH 1060, I, J, SPD(I), K, TEMP(I), PTG(I), L, ALPHA            S0104170
  650 CONTINUE                                                          S0104180
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      NS = 1                                                            S0104190
      NT = 12                                                           S0104200
      DO 680 I = 1,2                                                    S0104210
      IF (I .EQ. 1) GO TO 670                                           S0104220
      NS = 13                                                           S0104230
      NT = 24                                                           S0104240
  670 NDP = NDP + 1                                                     S0104250
      IF (NDP .LT. 8) GO TO 675                                         S0104260
      NDP = 1                                                           S0104270
      WRITE (IO,1210) ITITLE                                            S0104280
  675 WRITE (IO,1110) (J,J=NS,NT), MET1(2,1)                            S0104290
      WRITE (IO,1120) (DIR(J),J=NS,NT), MET1(3,1), (SPD(J),FLG(J),J=NS,NS0104300
     .T), MET1(4,1), AHM, (HM(J),J=NS,NT), JDAY, (TEMP(J),J=NS,NT), TSR1S0104310
     ., APTG, (PTG(J),J=NS,NT), TSS1, AS, (KST(J),J=NS,NT)              S0104320
  680 CONTINUE                                                          S0104330
C.....                                                                  S0104340
C..... SWAP MET DATA.                                                   S0104350
C.....                                                                  S0104360
  900 DO 910 N = 1,24                                                   S0104370
      IF (MET1(9,N) .EQ. 0) GO TO 905                                   S0104380
      LWD = MET1(9,N)                                                   S0104390
  905 DO 910 I = 1,12                                                   S0104400
  910 MET1(I,N) = MET2(I,N)                                             S0104410
 1000 CONTINUE                                                          S0104420
C.....                                                                  S0104430
C..... END DAY LOOP                                                     S0104440
C.....                                                                  S0104450
      IF (IDAYS(NTDY) .EQ. 1) WRITE (IO,1220) NTDY                      S0104460
      WRITE (IO,1180) NTDP                                              S0104470
      STOP                                                              S0104480
C.....                                                                  S0104490
C..... ERROR MESSAGES                                                   S0104500
C.....                                                                  S0104510
 2000 WRITE (IO,1130) IST, MET1(1,IE), IYR, MET1(2,IE)                  S0104520
      GO TO 2050                                                        S0104530
 2010 WRITE (IO,1140) NDAY, JDAY, MET1(3,1), MET1(4,1)                  S0104540
      GO TO 2050                                                        S0104550
 2020 WRITE (IO,1150) IHR, MET1(5,IE)                                   S0104560
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      GO TO 2050                                                        S0104570
 2030 WRITE (IO,1170) IHMY, IHMM, IHMD, (MET1(I,1),I=2,4)               S0104580
      STOP                                                              S0104590
 2050 WRITE (IO,1160) ((MET1(I,N),I=1,12),N=1,24)                       S0104600
      STOP                                                              S0104610
C.....                                                                  S0104620
C..... FORMATS                                                          S0104630
C.....                                                                  S0104640
 1010 FORMAT (5I2)                                                      S0104650
 1020 FORMAT (I5,I2,1X,2F10.0,F2.0,14X,F4.0,F6.0)                       S0104660
 1030 FORMAT (80I1)                                                     S0104670
 1040 FORMAT (I5,4I2,3A1,22X,2I2,4X,I3,29X,A1,1X)                       S0104680
 1050 FORMAT (5X,3I2,1X,F5.0,13X,F5.0)                                  S0104690
 1055 FORMAT (I5,3I2,1X,F5.0,13X,F5.0)                                  S0104700
 1060 FORMAT (2X,I2,4X,I3,F8.2,2X,I7,F7.1,F5.3,A1,36X,F3.2)             S0104710
 1070 FORMAT (/5X,9HISW(1) = ,I1,53H - USE ACTUAL (0) OR MODIFIED (1) STS0104720
     .ABILITY CATEGORY.,/,                                              S0104730
     . 5X,9HISW(2) = ,I1,70H - USE HUMID (0) OR ARID (1) VERTICAL POTENTS0104740
     .IAL TEMPERATURE GRADIENTS.,/,                                     S0104750
     . 5X,9HISW(3) = ,I1,48H - COMPUTE RURAL (0) OR URBAN (1) MIXING DEPS0104760
     .THS.,/,                                                           S0104770
     . 5X,9HISW(4) = ,I1,40H - PROCESS ALL (0) OR SELECTED (1) DAYS.,/, S0104780
     . 5X,9HISW(5) = ,I1,47H - PUNCH CARDS (0) OR WRITE TO A DISC FILE (S0104790
     .1).)                                                              S0104800
 1080 FORMAT (/,5X,6HIST = ,I5,34H - NWS SURFACE STATION WBAN NUMBER,/, S0104810
     . 5X,6HIYR = ,I2,26H - YEAR OF SURFACE STATION,/,                  S0104820
     . 5X,7HALAT = ,F4.1,30H - LATITUDE OF SURFACE STATION,/,           S0104830
     . 5X,8HALONG = ,F5.1,31H - LONGITUDE OF SURFACE STATION,/,         S0104840
     . 5X,7HZONE = ,F2.0,28H - SURFACE STATION TIME ZONE,/,             S0104850
     . 5X,8HALPHA = ,F4.2,32H - LATERAL DIFFUSION COEFFICIENT,/,        S0104860
     . 5X,6HCON = ,F7.1,30H - RURAL MIXING DEPTH CONSTANT)              S0104870
 1090 FORMAT (/5X,8HIDAYS = ,10(10I1,1X),/,3(13X,10(10I1,1X),/))        S0104880
 1100 FORMAT (/5X,58HNOTE: WIND SPEED OF 1.00* INDICATES AN HOUR OF CALMS0104890
     . WINDS./11X,81HWIND SPEED OF 1.00 INDICATES WIND SPEED GREATER THAS0104900
     .N 0, BUT LESS THAN 1.00 M/SEC.)                                   S0104910
 1110 FORMAT (/,18H HOUR (LOCAL TIME),10X,12(3X,I2,2X),7H YEAR =,8X,I2) S0104920
 1120 FORMAT (21H WIND DIRECTION (DEG),6X,12(3X,F4.0),9H  MONTH =,7X,I2/S0104930
     . 17H WIND SPEED (M/S),11X,12(1X,F5.2,A1),6H DAY =,9X,I2,/,        S0104940
     . 3A2,17H MIXING DEPTH (M),4X,12(1X,F6.0),15H  JULIAN DAY = ,I3,/, S0104950
     . 20H TEMPERATURE (DEG K),7X,12(2X,F5.1),11H  SUNRISE =,F7.3,/,    S0104960
     . 3A2,18H DLTH/DZ (DEG K/M),5X,F5.3,11(2X,F5.3),10H  SUNSET =,F8.3/S0104970
     . 11H STABILITY ,5A2,6X,12(6X,I1))                                 S0104980
 1130 FORMAT (/63H *** STATION NUMBER OR YEAR OF SURFACE MET DATA IS IN S0104990
     .ERROR ***,/,25H CONTROL CARD WBAN NO. = ,I5,28H SURFACE STATION WBS0105000
     .AN NO. = ,I5,/,21H CONTROL CARD YEAR = ,I2,24H SURFACE STATION YEAS0105010
     .R = ,I2)                                                          S0105020
 1140 FORMAT (/51H *** JULIAN DAY OF SURFACE MET DATA IS IN ERROR ***,/ S0105030
     . 21H JULIAN DAY SHOULD BE,I3,7H BUT IS,I3,31H MONTH AND DAY ARE RES0105040
     .SPECTIVELY,2I3)                                                   S0105050
 1150 FORMAT (/41H *** HOUR OF SURFACE DATA IS IN ERROR ***,/,          S0105060
     . 15H HOUR SHOULD BE,I3,7H BUT IS,I3)                              S0105070
 1160 FORMAT (/56H SURFACE DATA FOR THE DAY CURRENTLY BEING PROCESSED ARS0105080
     .E:,/,55H STA NO YR MO DY HR CEILING WIND DIR WIND SPD TEMP SKY,/, S0105090
     . 24(2X,I5,4I3,3X,3A1,6X,I3,6X,I3,3X,I3,4X,A1/))                   S0105100
 1170 FORMAT (/65H *** DATES OF MIXING DEPTH DATA AND SURFACE DATA DO NOS0105110
     .T AGREE ***,/,37H MIXING DEPTH DATA YEAR, MONTH, DAY =,3I4,/,     S0105120
     . 32H SURFACE DATA YEAR, MONTH, DAY =,3I4)                         S0105130
 1180 FORMAT (//,1X,I3,15H DAYS PROCESSED)                              S0105140
 1190 FORMAT (/5X,32HMIXING DEPTH DATA IS AT STATION ,I5,10H FOR YEAR , S0105150
     . I2)                                                              S0105160
 1200 FORMAT (40A2)                                                     S0105170
 1210 FORMAT (1H1,20X,40A2)                                             S0105180
 1220 FORMAT (//,48H NOTE: METEOROLOGICAL INPUTS FOR HOUR 24 OF DAY ,I3,S0105190
     . 49H ARE ARBITRARILY SET EQUAL TO INPUTS FOR HOUR 23.)            S0105200
      END                                                               S0105210
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C.....                                                                  S0200010
C.....                                                                  S0200020
C.....                                                                  S0200030
      SUBROUTINE SRSS (JD, TSR, TSS, AMM, DS, DC)                       S0200040
C.....                                                                  S0200050
C..... THIS SUBROUTINE COMPUTES SUNRISE AND SUNSET.                     S0200060
C.....                                                                  S0200070
      COMMON /CSRSS/ SLAT, CLAT, T, C1                                  S0200080
      DATA C2 /0.0172028/                                               S0200090
C.....                                                                  S0200100
C..... C2 = 0.0172028 = 360./(365.242*57.29578)                         S0200110
C.....                                                                  S0200120
      DN = (JD-1.0)*C2                                                  S0200130
      TDN = 2.*DN                                                       S0200140
      SDN = SIN(DN)                                                     S0200150
      CDN = COS(DN)                                                     S0200160
      STDN = SIN(TDN)                                                   S0200170
      CTDN = COS(TDN)                                                   S0200180
      SIG = 279.9348 + (DN*C1) + 1.914827*SDN - 0.079525*CDN +          S0200190
     . 0.019938*STDN - 0.00162*CTDN                                     S0200200
      DS = 0.39785*SIN(SIG/C1)                                          S0200210
      DC = SQRT(1.0-DS*DS)                                              S0200220
      AMM = 12.0 + 0.12357*SDN - 0.004289*CDN + 0.153809*STDN +         S0200230
     . 0.060783*CTDN                                                    S0200240
      HC = (-SLAT*DS)/(CLAT*DC)                                         S0200250
      H2 = (ATAN2(SQRT(1.-HC*HC),HC)/15.0)*C1                           S0200260
      TSR = AMM - H2 + T                                                S0200270
      TSS = AMM + H2 + T                                                S0200280
      RETURN                                                            S0200290
      END                                                               S0200300
      FUNCTION UNRAN(Z)                                                 S0300010
C.....                                                                  S0300020
C..... UNIFORM PSUFDO-RANDOM NUMBER GENERATOR BY THE MIXED              S0300030
C..... MULTIPLICATIVE CONGRUENTIAL METHOD.                              S0300040
C.....                                                                  S0300050
C..... THIS FUNCTION RETURNS A REAL NUMBER IN THE RANGE 0.0$UNRAN$=1.0  S0300060
C.....                                                                  S0300070
      DOUBLE PRECISION A1, A, X, XM, B, C                               S0300080
      DATA X /5.66387D5/                                                S0300090
      DATA A /1.027D3/                                                  S0300100
      DATA XM /1.048576D6/                                              S0300110
      A1 = A*X                                                          S0300120
      B = A1/XM                                                         S0300130
      C = B*1.0E-4                                                      S0300140
      J = C                                                             S0300150
      C = FLOAT(J)*1.0E4                                                S0300160
      J = B - C                                                         S0300170
      B = C + FLOAT(J)                                                  S0300180
      X = A1 - B*XM                                                     S0300190
      Z = X/XM                                                          S0300200
      UNRAN = Z                                                         S0300210
      RETURN                                                            S0300220
      END                                                               S0300230
```